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Animal and Plant Health Inspection Service
Wildlife Services
National Wildlife Research Center

Wildlife Hazard Management At Airports

A manual for airport personnel
prepared by

Edward C. Cleary
U. S. Department of Transportation
Federal Aviation Administration

Richard A. Dolbeer
U. S. Department of Agriculture
Wildlife Services

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AUTHORS

Edward C. Cleary, Staff Wildlife Biologist, Office of Airport Safety and Standards, Federal Aviation Administration, 800 Independence Ave. SW, Washington, DC 20591

Richard A. Dolbeer, Project Leader, U.S. Department of Agriculture, Wildlife Services, National Wildlife Research Center, 6100 Columbus Ave., Sandusky, OH 44870

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CHAPTER 1

INTRODUCTION TO THE WILDLIFE STRIKE PROBLEM

Throughout history, humans have been intrigued and inspired by the beauty of birds and their ability to fly. Birds first took to the air about 150 million years ago. Humans began to share airspace with birds only 100 years ago. Unfortunately, when aircraft and birds attempt to use the same airspace at the same time, collisions occur. Birds are not the only wildlife problem for aircraft. Deer, coyotes, and even alligators wandering onto runways can create serious problems for departing and landing aircraft. Aircraft collisions with wildlife, also commonly referred to as wildlife strikes, annually cost the United States civil aviation industry over $300 million in direct damage and associated cost, and over 500,000 hours of aircraft down time. Although the economic costs of wildlife strikes are extreme, the cost in human lives lost, greater than 100 in the USA since 1960, best illustrates the need for management of the wildlife strike problem. This handbook is designed to inform airport personnel about the scope of the wildlife strike problem and to serve as a ready reference regarding legal authority, regulations and the development, implementation and evaluation of Wildlife Hazard Management Plans for airports.

A flock of 300 European starlings competes for airspace with a MD-80 aircraft during landing approach at an airport in New York, 1998. (Photo by R. A. Dolbeer, USDA)

The wildlife strike problem is not new. Five years after his first flight in 1903, Orville Wright reported striking a bird while flying near Dayton, Ohio. On 3 April 1912 Calbraith Rogers, the first person to fly across the continental USA, became the first fatality as a result of a bird strike. Since those first wildlife strikes, aircraft designs have changed radically and wildlife populations and air traffic have increased. As a result, at least 78 civil aircraft and 201 civilian lives have been lost worldwide due to wildlife

Calbraith Rogers and the wreckage of his plane, the "Vin Fizz." Rogers, the first man to fly across the United States, was also the first to die as a result of a bird strike. (Photo courtesy National Air and Space Museum, Smithsonian Institution, SI Neg. No. A-43520-E)

strikes since 1960. Since 1960, at least 250 military aircraft and 120 military personnel have been lost because of wildlife strikes.

The onset of the jet age revolutionized air travel, but magnified the wildlife strike problem. Early piston-powered aircraft were noisy and relatively slow. Wildlife could usually avoid these aircraft, and strikes that did occur typically resulted in little or no damage. However, modern jet aircraft are fast, relatively quiet, and their engine fan blades are often more vulnerable than propellers to wildlife strike damage. When jets collide with birds or other wildlife, serious structural damage and engine failure can occur. Multiple-engine damage from the ingestion of flocks of birds is of particular concern as the fleet of 2-engine passenger aircraft increases in the USA. In 1969, 75% of the 2,100 passenger aircraft had 3 or 4 engines. By 1998, the fleet had grown to 5,400 primarily turbine-powered aircraft of which only 30% had 3 or 4 engines. By 2008, the fleet will consist of about 7,000 aircraft and less than 10% will have 3 or 4 engines.

Air travel has become commonplace in the United States. Aircraft have also assumed a vital role in tactical and logistical military operations. These factors have resulted in increased air traffic. For example, commercial air movements in the United States increased about 3% per year, 1985-1997. Coincidentally, human use of the skies has increased during an extremely successful period of wildlife management in North America. Aggressive natural resource programs by public and private wildlife management groups have contributed to impressive increases in populations of many species such as alligators, cranes, deer, geese, gulls, herons, pelicans, raptors (falcons, hawks, eagles, and owls), and vultures. At the same time, Canada geese, coyotes, deer, and other wildlife have expanded into suburban and urban areas, including airports, and are thriving in response to changes to habitats in these areas. These concurrent increases in air traffic and wildlife populations contribute to an increased probability of wildlife strikes. These two factors, combined with the increased speed, quietness and vulnerability of modern aircraft, interact to form the basis of the wildlife strike problem that airport managers face. As a final factor, airport managers also face increased concerns about airport liability in the aftermath of damaging wildlife strikes.

In the 1960s, 4-engine aircraft such as the Lockheed Constellation (top) comprised 75% of the U.S. fleet of passenger aircraft. By 2008, an estimated 90% of the fleet will be 2-engine aircraft, such as the Boeing-777 (bottom). (Constellation photo by Bob Shane, Constellation Group; Boeing-777 photo by Dino)

Wildlife strike problems at individual airports result from these above-described factors interacting at the local scale. The nature and magnitude of the problem an individual airport faces will depend on many factors, including air traffic type and volume, local and migratory wildlife populations, and local wildlife habitat conditions. Wildlife are attracted to an airport environment because desirable food, water or habitat is present. The majority of wildlife strikes occur within the immediate airport environment: 78% of all strikes occur under 1,000 feet above ground level (AGL). Of these, 35% occur during takeoff and climb, and 49% occur during approach and landing roll. Therefore, most wildlife involved in strikes are using the airport or its immediate vicinity, and the most logical place to begin correcting the problem is on and near the airport.

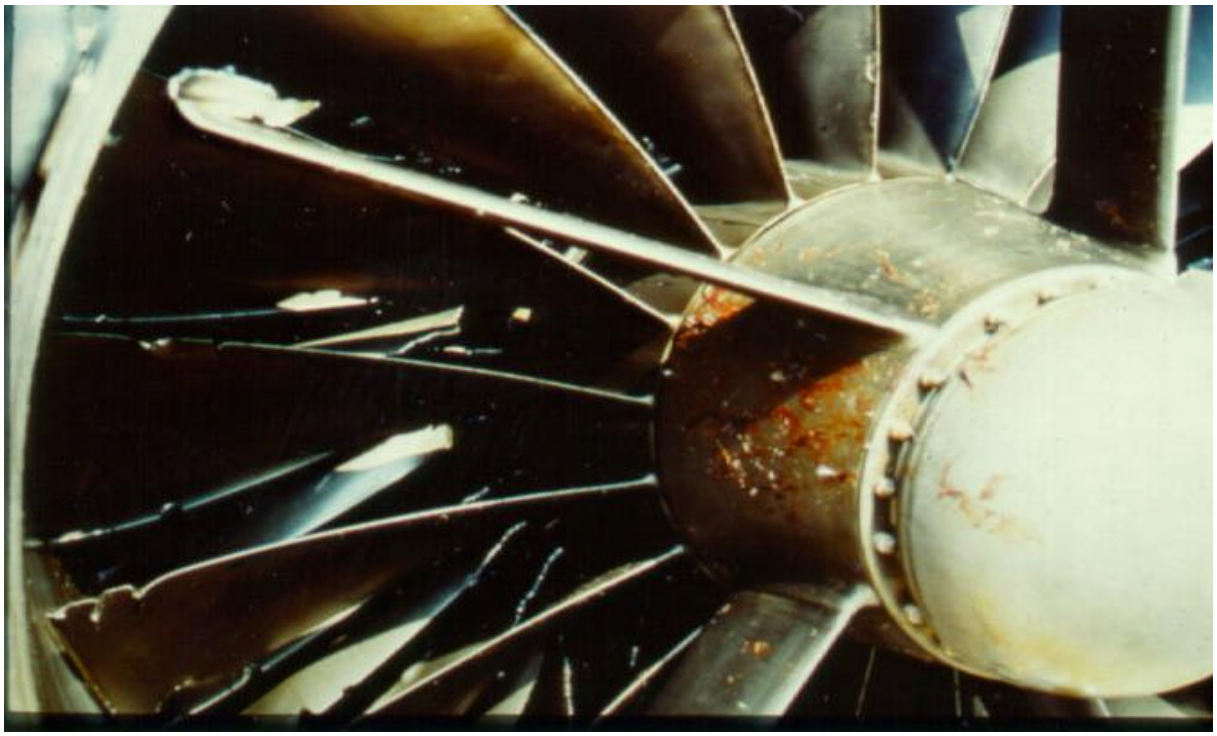
Airport sponsors and managers have a legal responsibility to ensure that the airport maintains a safe operating environment. As part of this responsibility, they must first assess the risk and magnitude of the wildlife strike problem for their airport. This assessment must include a review of all strike incidents, assessment of wildlife using the airport environment and assessment of wildlife habitat available to wildlife on the airport. Based on airport conditions and assessed strike risk, airport personnel may need to devise a Wildlife Hazard Management Plan for reducing strike risk and occurrence. Airport personnel must then act to implement and periodically evaluate the plan.

This manual contains a compilation of information to assist airport personnel in the development, implementation, and evaluation of Wildlife Hazard Management Plans at airports. The manual includes specific information on the nature of wildlife strikes, legal authority, regulations, wildlife management techniques, wildlife hazard assessments, wildlife hazard management plans and sources of help and information.

It is emphasized that this manual provides only a starting point for addressing wildlife hazard issues at airports. Wildlife management is a complex discipline and conditions vary widely across the United States. Therefore, the development of Wildlife Hazard Management Plans and the implementation of management actions by airport personnel should be under consultation by qualified wildlife biologists trained in wildlife damage control.

CHAPTER 2

THE FAA NATIONAL WILDLIFE STRIKE DATABASE FOR CIVIL AVIATION

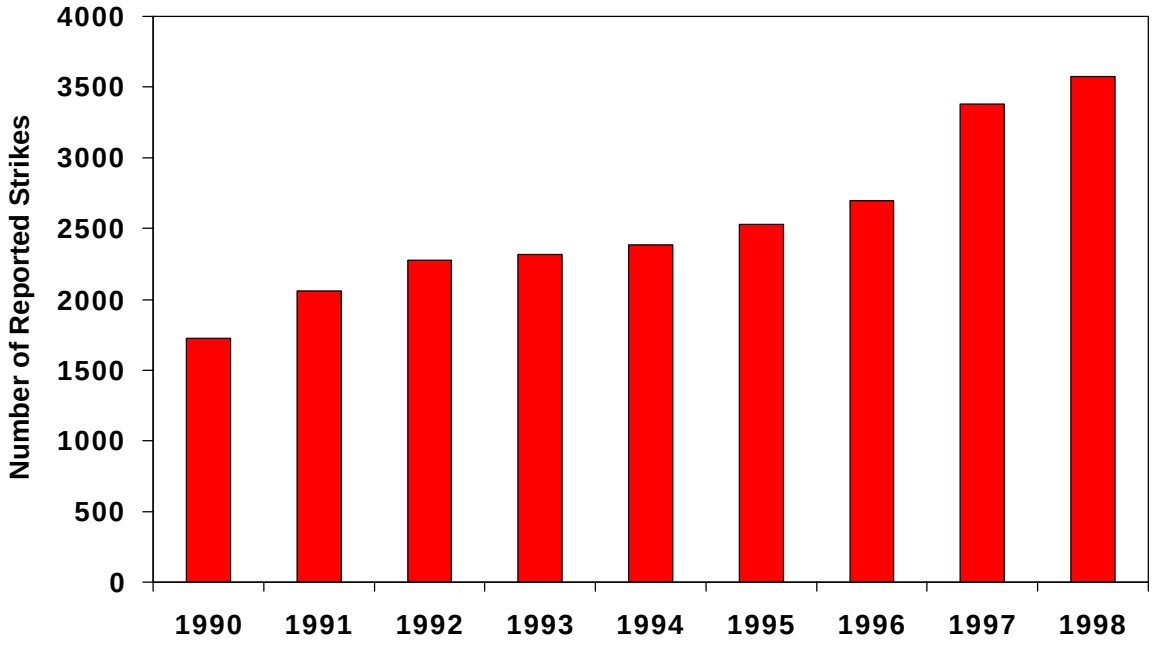


This engine from an Air France Concord jet ingested 1 or 2 Canada geese during landing at John F. Kennedy International Airport, 3 June 1995. The engine suffered an uncontained failure. (Photo by R. A. Dolbeer, USDA)

2.1 INTRODUCTION

Before a problem can be solved, the problem must first be understood. A necessary first step toward understanding the complex problem of aircraft collisions with wildlife is the collection and analysis of data from actual wildlife strike events. This chapter provides an overview of the structure and management of the Federal Aviation Administration (FAA) National Wildlife Strike Database for Civil Aviation. The chapter emphasizes the need for accurate reporting of wildlife strikes and the methods for reporting strike events. A statistical summary of reported wildlife strikes for civil aircraft, 1990-1998, is also presented to demonstrate the types of information obtained from the database. Finally, a list of selected individual strike cases provides an overview of the nature and magnitude of the wildlife strike problem in the United States.

Figure 2-1. Reported wildlife strikes to civil aircraft by year, USA, 1990-1998 (n = 22,935 total strikes).



2.2 REPORTING WILDLIFE STRIKES

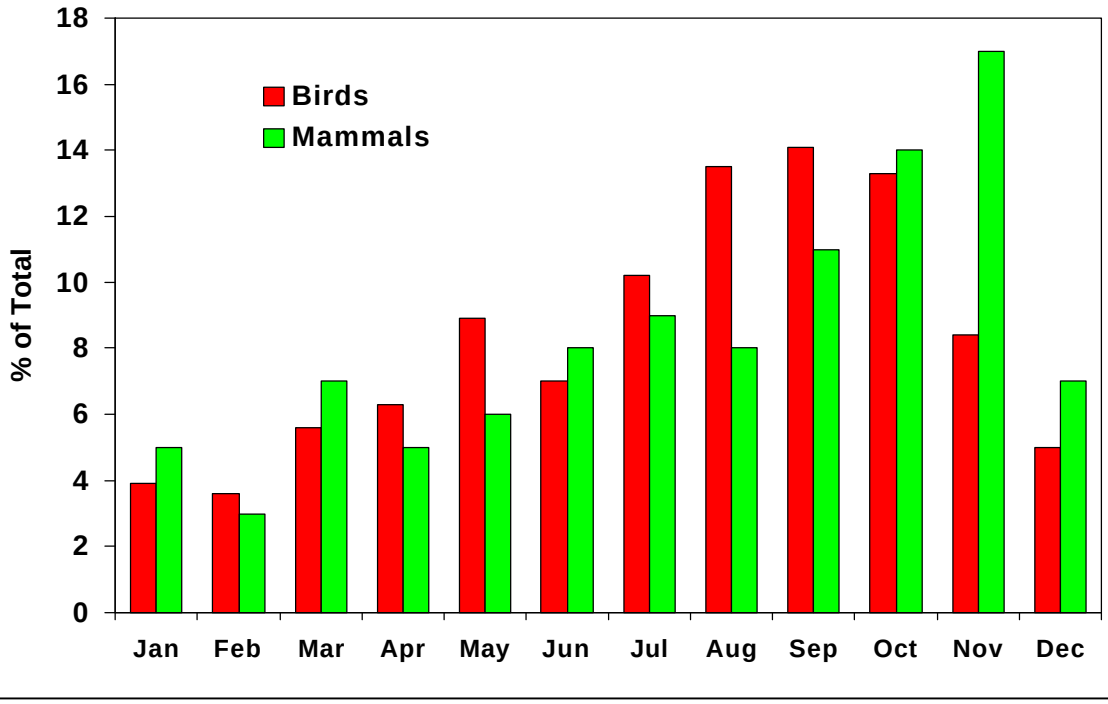
The FAA has a standard form (FAA Form 5200-7 - Bird/Other Wildlife Strike Report [see Appendix H]) for the voluntary reporting of bird and other wildlife strikes with aircraft. To improve the ease of reporting, strikes can also be reported via the Internet (http://www.faa.gov/arp/birdstrike).

Strikes should be reported by pilots, airport operations and aircraft maintenance personnel, or anyone else who has knowledge of the strike. It is important to include as much information as possible on FAA Form 5200-7. The identification of the species of wildlife struck is particularly important. Bird strike remains that can not be identified by airport personnel can often be identified by a local biologist or by sending feather remains in a sealed plastic bag (with FAA Form 5200-7) to:

Federal Aviation Administration
Office of Airport Safety and Standards, AAS-310
800 Independence Avenue, SW
Washington, DC 20591

Chapter 8 provides more details on strike reporting.

Figure 2-2. Reported bird and mammal strikes to civil aircraft by month, USA, 1990-1998 (% of total strikes, n = 22,320 birds; 580 mammals).



Analyses of wildlife strike data have proven invaluable in determining the magnitude and severity of the wildlife strike problem. The database provides a scientific basis for identifying risk factors, justifying, implementing and defending corrective actions at airports, and for judging the effectiveness of those corrective actions. The database is also of value to engine manufacturers and aeronautical engineers.

2.3 MANAGEMENT OF DATABASE

The FAA National Wildlife Strike Database is managed by the National Wildlife Research Center (NWRC) of the U.S. Department of Agriculture's Wildlife Services program under terms of an Interagency Agreement with FAA. All strike reports are sent to the NWRC for entry into the database after review by the staff Wildlife Biologist at FAA, Office of Airport Safety and Standards. At the NWRC, a database manager edits each strike report and consolidates multiple reports for the same strike before entering the data. Contacts with persons making reports are sometimes made for clarification of details. In addition to FAA Form 5200-7, strike reports are also obtained from other sources (Table 2-1). After entry into the database, the original reports are filed chronologically for future reference if necessary. There are approximately 23,000 strike records in the database for 1990-1998.

Table 2-1. Source of information for reported wildlife strikes to civil aircraft, USA, 1990-1998.

Source	Reported strikes (1990-1998)		
	9-year total	9-year avg.	% of total
FAA Form 5200-7	17,308	1,923	75
Other[a]	2,069	230	9
Multiple	1,920	213	8
Airport Report	1,354	150	6
Airline Report	284	32	1
Total	22,935	2,548	100

[a] Preliminary Aircraft Incident Report; Aviation Safety Reporting System, Aircraft Incident Preliminary Notice, National Transportation Safety Board.

Table 2-2. Person filing report of wildlife strike to civil aircraft, USA, 1990-1998.

Person reporting	Reported strikes (1990-1998)		
	9-year total	9-year avg.	% of total
Pilot	6,353	706	28
Tower	3,878	431	17
Unknown	7,455	828	33
Carcass found[a]	1,686	187	7
Airport operations	1,477	164	6
Airline operations	1,323	147	6
Other	763	85	3
Total	22,935	2,548	100

[a] Airport operations personnel found wildlife remains on runway that appeared to have been struck by aircraft and no strike was reported by pilot, tower or airline.

Table 2-3. Number of reported wildlife strikes to civil aircraft by type of operator, USA, 1990-1998.

Operator	Reported strikes (1990-1998)		
	9-year total	9-year avg.	% of total
Commercial	16,611	1,846	72
Business	2,814	313	12
Private	961	107	4
Government/police	88	10	<1
Unknown	2,461	273	11
Total	22,935	2,548	100

2.4 USE OF INFORMATION IN DATABASE

Maintaining a consistent record of wildlife strikes at an airport is essential for defining the wildlife hazard level and for evaluating the airport's Wildlife Hazard Management Plan as discussed in Chapter 8. In addition to their internal use at the airport, the strike reports, when incorporated into the National Wildlife Strike Database, provide a means

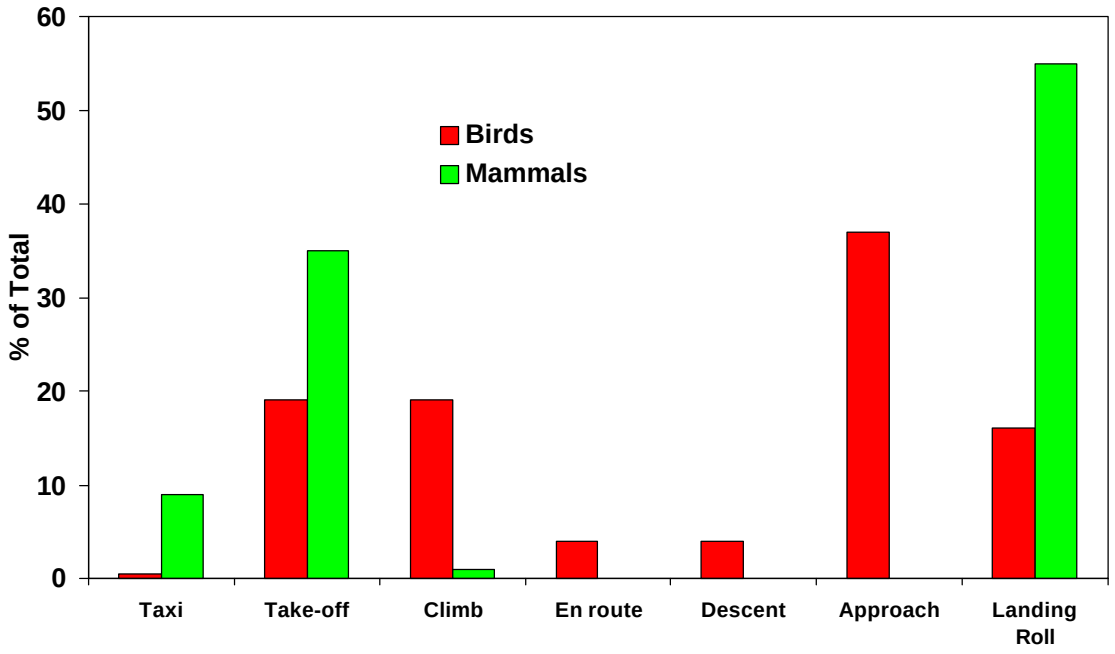
Table 2-4. Number of reported bird and mammal strikes to civil aircraft by U.S. state, including Puerto Rico (PR) and the U.S. Virgin Islands (VI), 1990-1998.

	Reported strikes (1990-1998)				Reported strikes (1990-1998)		
State	Birds	Mammals	Total	State	Birds	Mammals	Total
AK	215	5	220	ND	45	0	45
AL	282	4	286	NE	209	7	216
AR	125	11	126	NH	78	4	82
AZ	167	17	184	NJ	673	27	700
CA	2,017	20	2,037	NM	49	1	50
CO	261	7	268	NV	116	2	118
CT	317	13	330	NY	1,445	36	1,481
DC	571	18	589	OH	724	15	739
DE	14	1	15	OK	233	14	247
FL	2,056	29	2,085	OR	301	4	305
GA	454	9	463	PA	1,040	48	1,088
HI	474	1	476	PR	39	0	39
IA	172	3	175	RI	63	3	66
ID	51	4	55	SC	125	4	129
IL	1,235	43	1,238	SD	38	3	41
IN	232	5	237	TN	591	6	597
KS	66	2	68	TX	1,775	30	1,805
KY	603	4	607	UT	240	4	244
LA	531	6	537	VA	460	18	478
MA	326	7	333	VI	32	0	32
MD	268	16	284	VT	16	0	16
ME	100	4	104	WA	382	8	390
MI	409	26	435	WI	244	14	258
MN	206	6	212	WV	75	31	106
MO	400	13	413	WY	13	2	15
MS	100	3	103				
MT	36	1	37	USA total	21,257	574	21,831
NC	563	15	578	Foreign[a]	1,063	6	1,069
				Total	22,320	580	22,900

[a] Reported strikes to USA carriers at foreign airports.

for engineers, biologists, and safety analysts to better understand national and regional trends in strikes and thereby develop, justify and defend more effective management programs and wildlife-resistant aircraft and engines. For example, the database has been extremely useful in identifying which wildlife species are most commonly involved in strikes, the seasonal pattern of strikes for various species, the extent and types of damage resulting from strikes, and which aircraft types and components are most vulnerable. It is emphasized that the strike records in the national database are summarized statistically at the regional or national level for trends. Comparisons among individual airports and airlines are not made.

Figure 2-3. Reported phase of flight at time of bird and mammal strikes to civil aircraft, USA, 1990-1998 (% of total strikes in which phase of flight was reported, n = 19,728 for birds; n = 494 for mammals).



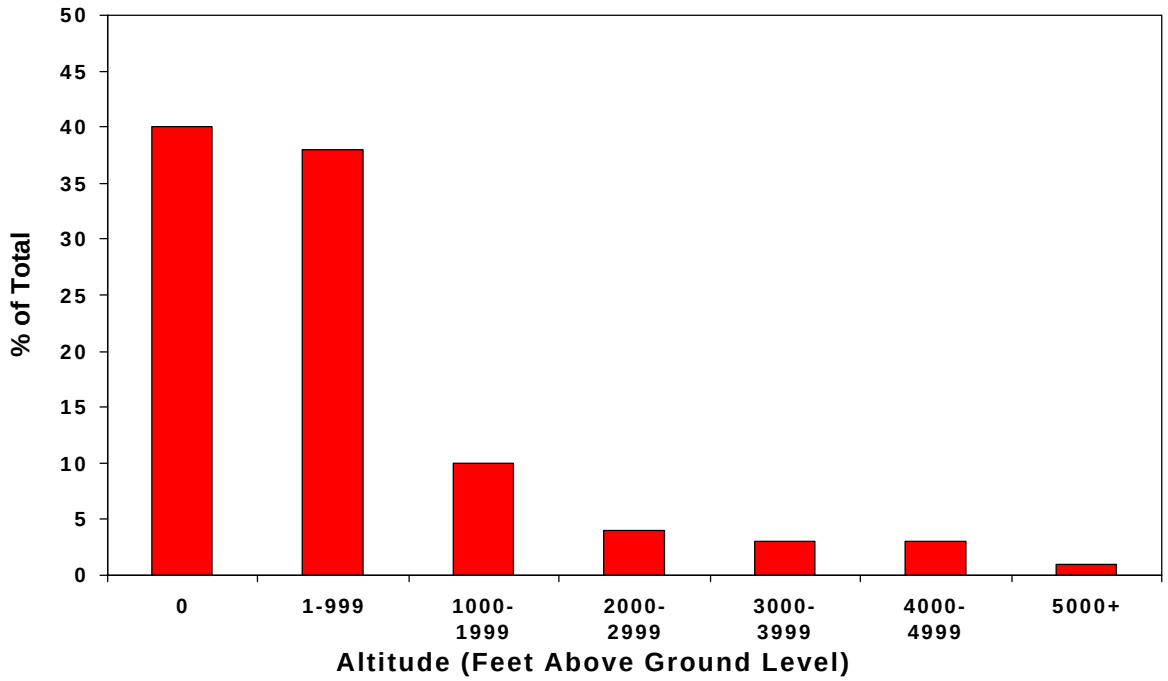
2.5 SUMMARY OF WILDLIFE STRIKE RECORDS, 1990-1998

The FAA's Office of Airport Safety and Standards publishes an annual report, *Wildlife Strikes to Civil Aircraft in the United States*. This report contains a detailed analysis of the most current strike data. Copies of the current annual report can be downloaded from the FAA's Wildlife Hazard Web page at: http://www.faa.gov/arp/hazard.htm.

The following section presents a summary analysis of reported wildlife strikes to civil aircraft in the USA for 1990-1998 to provide an overview of the types of information obtained from the database. Reports were received from all 50 states, some U.S.

territories, and from foreign countries when U.S. registered aircraft were involved in a strike. Because less than 20% of all strikes have been reported to the FAA and many reports received by the FAA were filed before aircraft damage was fully assessed, the number of strikes and associated cost data compiled from the voluntary reporting program greatly underestimate the magnitude of the problem.

Figure 2-4. Number of reported bird strikes to civil aircraft by altitude, USA, 1990-1998 (% of total strikes for which altitude was reported, n = 18,080).



2.5.a Strike Frequency

For the 9-year period, 22,935 strikes (average of 2,548/year) were reported to the FAA. From 1990 to 1998, there was a 107% increase in the number of strikes reported annually (Figure 2-1). Most reports (75%) were filed using FAA Form 5200-7 (Table 2-1). Pilots and tower personnel filed 28% and 17% of the reports, respectively (Table 2-2). About 72% of the reported strikes involved commercial aircraft; the remainder involved business, private, and miscellaneous aircraft (Table 2-3). Table 2-4 shows the distribution of reported bird and mammal strikes for the various states and territories. Florida, California and Texas had the most strike reports.

2.5.b Types of Wildlife Involved

Birds were involved in 97% of the reported strikes, mammals in 3%, and <1% involved reptiles. Gulls, raptors, blackbirds, waterfowl, and doves (including pigeons) were the most commonly struck bird groups (Table 2-5). The most commonly struck mammals were deer and coyotes (Table 2-6). Gulls were involved in 2.6 times as many strikes as waterfowl, but both groups were involved in about the same number of damaging strikes (Table 2-5).

2.5.c Characteristics of Strikes

Most bird strikes (50%) occurred between July and October (Figure 2-2); 66% occurred during the day (Table 2-7); 55% occurred when the aircraft was on approach or during the landing roll, and 39% occurred during takeoff and climb (Figure 2-3). About 40% of bird strikes occurred when the aircraft was at 0 feet above ground level (AGL), 78% occurred under 1,000 ft. AGL (Figure 2-4).

Table 2-5. Identified birds involved in reported wildlife strikes to civil aircraft, USA, 1990-1998.

Bird group	9-year total	% of total known	No. (%) of strikes causing damage
Gulls/terns	3,252	30	578 (18)
Raptors	1,366	13	307 (23)
Blackbirds/starlings	1,340	12	72 (5)
Waterfowl	1,243	12	578 (47)
Doves/pigeons	1241	11	134 (11)
Sparrows	788	7	17 (2)
Wading birds (herons, egrets)	474	3	62 (19)
Shorebirds (plovers, sandpipers)	334	3	40 (11)
Swallows/swifts	278	3	4 (1)
Miscellaneous perching birds	270	3	12 (4)
Corvids (crows, jays, etc.)	199	2	20 (10)
Gallinaceous birds (pheasants, etc.)	61	1	19 (31)
Miscellaneous birds	86	1	12 (14)
Total known	10,831	100	1,855 (17)
Total unknown	11,489[a]		
Total	22,230		

[a] There were 22,320 bird strikes reported; 11,489 (52%) provided no information on species of bird.

The greatest percentage of mammal strikes (31%) occurred during October-November (Figure 2-2); 61% occurred at night (Table 2-7); 60% occurred when the aircraft was on approach or landing; and 34% occurred during takeoff (Figure 2-3). About 12% of reported mammal strikes occurred while the aircraft was in the air, when aircraft struck deer with the landing gear or encountered bats (Figure 2-3).

Table 2-6. Identified mammal and reptile groups involved in reported wildlife strikes to civil aircraft, USA, 1990-1998.

Wildlife group	9-year total	% of total known	No. (%) of strikes causing damage
Mammals			
Deer & other ungulates	385	67	311 (81)
Coyotes & other carnivores	112	20	10 (9)
Bats	27	5	2 (7)
Rodents	18	3	0 (0)
Opossum	14	2	0 (0)
Armadillos	11	2	0 (0)
Rabbits/hares	6	1	0 (0)
Total known mammals	573	100	323 (56)
Total unknown mammals	7		
Total mammals	580		
Reptiles			
Turtles	25	71	0 (0)
Alligators	10	29	1 (10)
Total reptiles	35	100	1 (3)

2.5.d Aircraft Components Struck and Damaged

Aircraft components most commonly reported struck by birds were radome/nose, windshield, engine, and wing/rotor (Table 2-8). Those components most often reported as damaged were engine, wing/rotor, radome/nose, and windshield. Aircraft components most commonly reported as struck by mammals were landing gear, propeller, wing/rotor, and engine (Table 2-8). These same components ranked highest for the parts most often reported as damaged. About 19% of strikes resulted in minor

Table 2-7. Reported time of occurrence of wildlife strikes to civil aircraft, USA, 1990-1998.

	Birds		Mammals	
Time	9-year total	% of total known	9-year total	% of total known
Dawn	824	4	10	2
Day	13,551	66	132	26
Dusk	1,017	5	52	10
Night	5,186	25	307	61
Total reported	20,578	100	501	100
Not reported	1,742		79	
Total	22,320		580	

to substantial damage to the aircraft (Table 2-9).

Table 2-8. Civil aircraft components reported as being struck and damaged by birds and mammals, USA, 1990-1998.

	Birds (9-year total)		Mammals (9-year total)	
Part of Aircraft	Struck	Damaged	Struck	Damaged
Radome/nose	4,687	571	33	27
Windshield	3,539	308	7	4
Engine	3,201	1,357	51	49
Wing/rotor	2,544	873	63	65
Fuselage	2,107	136	35	33
Landing Gear	1,049	147	187	122
Propeller	722	86	82	72
Tail	298	145	21	24
Light	184	157	6	6
Other	610	298	55	55
Total	18,941	4,078	540	457

2.5.e Effects of Wildlife Strikes on Aircraft and Flights

For the 9-year period, 3,773 reports (19% of known total) indicated the strike damaged one or more aircraft components (Table 2-9), and 2,434 reports (15% of known total) indicated the strike had a negative effect on the flight (Table 2-10). Only 988 strike reports provided an estimate of the aircraft down time (total = 163,667 hours, average = 166 hours/incident), and 759 reports provided an estimate of the direct or other costs (total = $74,407,875, average = $139,650/incident). Of the 759 reports providing a damage cost estimate, 681 provided an estimate of direct aircraft damage (total = $61,877,083, average = $90,887/incident), and 262 provided an estimate of other monetary losses (total = $12,513,130, average = $47,764/incident).

Table 2-9. Reported damage resulting from wildlife strikes to civil aircraft, USA, 1990-1998.

Damage	9-year total	% of known total
None	16,283	81
Minor[a]	2,086	10
Unknown[b]	400	2
Substantial[c]	1,268	6
Destroyed[d]	19	<1
Total reported	20,056	100
Not reported	2,879	
Total	22,935	

[a] Aircraft can be rendered airworthy by simple repairs or replacements and an extensive inspection is not necessary.

[b] Aircraft was damaged, but details as to the extent of damage are lacking.

[c] Aircraft incurs damage or structural failure which adversely affects the structure strength, performance or flight characteristics and which would normally require major repair or replacement of the affected component. Specifically excluded are: bent fairings or cowlings; small dents or puncture holes in the skin; damage to wing tips, antenna, tires or brakes; engine blade damage not requiring blade replacement.

[d] Damaged sustained makes it inadvisable to restore aircraft to an airworthy condition.

Table 2-10. Reported effect-on-flight of wildlife strikes to civil aircraft, USA, 1990-1998.

Effect-on-flight	Birds		Mammals	
	Total	% of known total	Total	% of known total
None	13,290	86	135	37
Aborted takeoff	557	4	66	18
Precautionary landing	1,126	7	39	11
Engine shut down	128	1	8	2
Other	391	2	119	32
Total reported	15,492	100	367	100
Not reported	6,828		213	
Total	22,320		580	

Assuming all reported wildlife-aircraft strikes that had an adverse effect on the aircraft and/or flight produced similar amounts of down time and/or monetary losses, and that these reports are all of the damaging strikes that occurred, wildlife strikes cost the U.S. civil aviation industry a minimum of 92,233 hours/year of aircraft down time, $50.6 million/year in direct monetary losses, and $26.6 million/year in associated costs. Further, assuming a 20% reporting rate, the cost of wildlife-aircraft strikes to the U.S. civil aviation industry is estimated to be in excess of 461,165 hours/year of aircraft

down time, $253 million/year in direct monetary losses and $133 million/year in associated costs.

2.6 SELECTED EXAMPLES OF WILDLIFE STRIKES

Below is a description of some significant wildlife strikes that have influenced flight safety policy or are typical of damaging strikes in the USA.

- **3 April 1912**. Calbraith Rogers, the first person to fly across the continental United States, was also the first to die as a result of a bird strike. On April 3, 1912, Rogers' Wright Pusher struck a gull, causing the aircraft to crash into the surf at Long Beach, California. Rogers was pinned under the wreckage and drowned.

- **10 March 1960.** A Lockheed Electra turbo-prop ingested European starlings into all 4 engines during takeoff from Boston Logan Airport (MA). The plane crashed into Boston Harbor, killing 62 people. Following this accident, the FAA initiated action to develop minimum bird ingestion standards for turbine-powered engines.

- **26 February 1973.** On departure from Atlanta's Dekalb-Peachtree Airport (GA), a Learjet 24 struck a flock of brown-headed cowbirds attracted to a nearby trash transfer station. Engine failure resulted. The aircraft crashed, killing 8 people and seriously injuring 1 person on the ground. This incident prompted the FAA to develop guidelines concerning the location of solid waste disposal facilities on or near airports.

A DC-10 is engulfed in flames at John F. Kennedy International Airport in the aftermath of a strike with gulls in November 1975. (Photo courtesy Port Authority of New York and New Jersey)

- **12 November 1975.** On departure roll from John F. Kennedy International Airport (NY), the pilot of a DC-10 aborted takeoff after ingesting gulls into 1 engine. The plane ran off the runway and caught fire as a result of engine fire and overheated brakes. The resultant fire destroyed the aircraft. All 138 people on board were airline personnel who had received emergency evacuation training. They all evacuated safely. Following this accident, the National Transportation Safety Board recommended the FAA evaluate the effect of bird ingestion on large, high-bypass, turbofan engines and the adequacy of engine certification standards. The FAA initiated a nationwide data collection effort for documenting bird strike and engine ingestion events.

- **25 July 1978.** A Convair 580 departing Kalamazoo Airport (MI) ingested 1 American kestrel into an engine on takeoff. The engine autofeathered and aircraft crashed in nearby field, injuring 3 of 43 passengers.

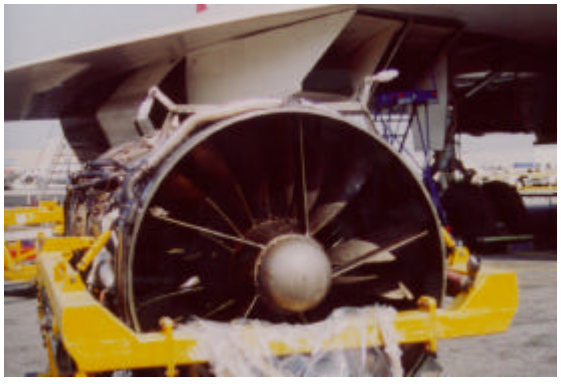
- **5 November 1990.** During takeoff at Michiana Regional Airport (IN), a BA-31 flew through a flock of mourning doves. Several birds were ingested in both engines and takeoff was aborted. Both engines were destroyed. Cost of repairs was $1 million and time out of service was 60 hours.

- **30 December 1991.** A Citation 550, taking off from Angelina County Airport (TX) struck a turkey vulture. The strike caused major damage to #1 engine and resulting shrapnel caused minor damage to the wing and fuselage. Cost of repairs was $550,000 and time out of service was 2 weeks.

- **2 February 1992.** A Piper Cherokee struck a deer at rotation during takeoff from Sandstone Municipal Airport (MN). The pilot attempted to turn back to airport but impacted into trees just south of airport. Aircraft was destroyed and pilot seriously injured.

- **3 December 1993.** A Cessna 550 struck a flock of geese during initial climb out of DuPage County Airport (IL). The pilot heard a loud bang and the aircraft yawed left and right. Instruments showed a loss of power to #2 engine and a substantial fuel leak on the left side. An emergency was declared and the aircraft landed at Midway Airport. Cost to repair 2 engines was $800,000 and time out of service was about 3 months.

- **21 October 1994.** A Cessna 210 struck a coyote during landing roll at Higginsville Industrial Municipal Airport (MO) at night. The nose gear collapsed, causing the propeller to hit runway, resulting in major damage to engine and crankshaft.



One engine from a Concorde showing damage from a goose strike in June 1995 at John F. Kennedy International Airport. (Photo by R. A. Dolbeer, USDA)

- **3 June 1995.** An Air France Concorde, at about 10 feet above ground level (AGL) while landing at John F. Kennedy International Airport (NY), ingested 1 or 2 Canada geese into the #3 engine. The engine suffered an uncontained failure. Shrapnel from the #3 engine destroyed the #4 engine and cut several hydraulic lines and control cables. The pilot was able to land the plane safely, but the runway was closed for several hours. Damage to the Concorde was estimated at over $7 million. The French Aviation

Authority sued the Port Authority of New York and New Jersey and eventually settled out of court for $5.3 million.

This is all that remains of one engine from the ill-fated AWACS aircraft, September 1995. (Photo courtesy USAF)

- **22 September 1995.** A U.S. Air Force Airborne Warning and Control System (AWACS) aircraft (modified Boeing-707) crashed, killing all 24 on board, after ingesting 4 Canada geese into #1 and #2 engines during takeoff from Elmendorf Air Force Base (AK). This was the first crash of an AWACS plane since the Air Force began using them in 1977. This strike involving a military aircraft is not included in the FAA National Wildlife Strike Database. It is listed here because of the severity of the incident.

- **5 October 1996.** A Boeing-727 departing Washington Reagan National Airport (DC) struck a flock of gulls just after takeoff, ingesting at least 1 bird. One engine began to vibrate and was shut down. A burning smell entered the cockpit. An emergency was declared and the aircraft, carrying 52 passengers, landed at Washington National. Several engine blades were damaged.

- **7 January 1997.** A MD-80 aircraft struck over 400 blackbirds just after takeoff from Dallas-Fort Worth International Airport (TX). Almost every part of the plane was hit. The pilot declared an emergency and returned to land without event. Substantial damage was found on various parts of the aircraft and the #1 engine had to be replaced. The runway was closed for an hour. About 100,000 blackbirds were roosting in the terminal area and were feeding on cereal grain crops on and in the vicinity of the airport.

- **15 November 1997.** During takeoff from John Wayne Airport (CA) an Airbus 320 ingested a large bird into 1 engine, causing a fire. Passengers reported hearing a loud boom. The aircraft dropped momentarily before recovering altitude. The aircraft circled for 30 minutes before making an emergency landing. There were no injuries. The bird hit and broke several blades on the starboard fan. Pieces of the broken blades then broke or bent all blades, caused damage to the cowling and to system behind the fan. The engine was replaced.

- **9 January 1998.** While climbing through 6,000 feet, following takeoff from Houston Intercontinental Airport (TX), a Boeing-727 struck a flock of snow geese with 3-5

birds ingested into 1 engine. The engine lost all power and was destroyed. The radome was torn from the aircraft and the leading edges of both wings were damaged. The pitot tube for the first officer was torn off. Intense vibration was experienced in the airframe and noise level in cockpit increased to the point that communication among crew members became difficult. An emergency was declared. The flight returned safely to Houston with major damage to the aircraft.

- **7 May 1998.** On climb out from Colorado Springs Metro Airport (CO), a Boeing-727 encountered at least 6 large white birds. The aircraft suffered an uncontained failure in #3 engine. All inlet guide vanes, all 1st and 2nd stage compressor blades, and 1st stage stator vanes were damaged. The birds punched a hole in the anti-ice bleed air duct and damaged a wiring harness. Intense vibration broke the oil cooler. The radome was cracked and a wing-tip had minor damage. The aircraft declared an emergency and returned safely to Colorado Springs Metro Airport. The aircraft was out of service for 98 hours.

- **15 August 1998.** A Jetstream-31 landing at Altoona-Blair County Airport (PA) hit a mixed flock of birds (22 doves and killdeer) during landing roll. One engine was shut down after ingesting birds. The engine was removed for overhaul.

- **22 February 1999.** A Boeing-757 departing Cincinnati/Northern Kentucky International Airport (KY) had to return and make emergency landing after hitting a large flock of starlings. Both engines and 1 wing received extensive damage. About 400 dead starlings were found on runway area.

- **3 March 1999.** A DC-9 cargo plane on short final into Kansas City International Airport (MO) at 2230 hours struck several snow geese. Geese were ingested into both engines. One engine was destroyed and the other lost 50% of power. The pilot was able to land the aircraft safely.

2.7 CONCLUSIONS

Wildlife strikes can cause serious damage to aircraft and the occasional loss of human life. Because most strikes occur on or near airports, airports are the logical places to put emphasis in addressing the problem. The following chapters and appendices, coupled with guidance from professional wildlife biologists trained in wildlife damage management, provide the information needed to develop, implement, and evaluate wildlife hazard management programs to minimize the likelihood of wildlife strikes at airports.

Wildlife are attracted to airports for food, water or shelter. The first step to reduce numbers of hazardous wildlife at airports is to determine the attractive factors. (Photo by E. A. LeBoeuf, USAF)

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CHAPTER 3

AGENCIES AND ORGANIZATIONS IMPACTING WILDLIFE HAZARD MANAGEMENT AT AIRPORTS

The pilot of this NATO Airborne Warning and Control System aircraft (modified Boeing-707) rejected takeoff following a bird ingestion at Aktion Air Force Base in Greece, July 1996. The plane slid off the runway, suffering extensive damage.

3.1 INTRODUCTION

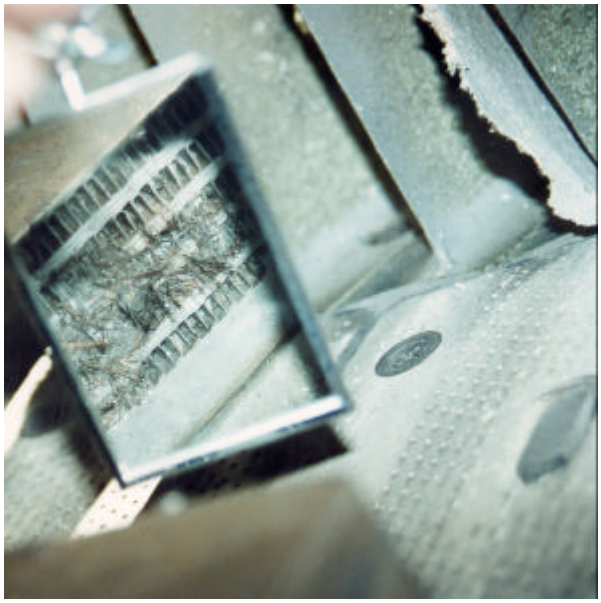
Wildlife management is a complex mixture of science, experience and art, regulated and implemented by various federal, state, and local governmental agencies. Wildlife and associated wildlife habitat often are protected by overlapping federal, state, and local regulations that are enforced by various governmental organizations. This chapter provides an overview of the roles and responsibilities of various agencies and organizations that influence wildlife management at or near airports.

3.2 FEDERAL AGENCIES[1]

3.2.a Federal Aviation Administration

3.2.a.i Mission

The mission of the Federal Aviation Administration (FAA) is to provide a safe, secure, and efficient global aviation system that contributes to national security and the promotion of U.S. aviation. As the leading authority in the international aerospace community, the FAA is responsive to the dynamic nature of customer needs, economic conditions, and environmental concerns.



Following a bird ingestion, National Transportation Safety Board (NTSB) inspectors used a mirror to examine the constant speed drive (CSD) oil cooler in this engine on a Boeing-737. Note the feathers shown in the mirror and the damaged compressor blade in the

3.2.a.ii Authority

Since 1970, Section 612 of the Federal Aviation Act of 1958, as amended, (49 U.S.C. 1432) has empowered the FAA Administrator to issue airport operating certificates to airports serving certain air carriers, and to establish minimum safety standards for the operation of those airports. Some of these regulations and policies directly involve the management of wildlife and wildlife hazards on and/or near airports.

3.2.a.iii Role and Responsibility

The FAA is responsible for enforcement of Title 14 Code of Federal Regulations, part 139 (14 CFR 139). To carry out this role, the FAA has responsibilities for various aspects of aviation which include air navigation, air traffic control, aviation certification and regulation, aviation security, environmental impact minimization, and aviation research and development.

The FAA roles and responsibilities relating to wildlife hazards and their associated human health and safety concerns are addressed in 14 CFR 139.337. The FAA's Office of Airport Safety and Standards has published Advisory Circulars (AC 150/5000

[1] Much of the information in this section was adapted from Chapter 2 of *Managing Wildlife Hazards at Airports*, U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, June 1998 (used with permission).

series), Certalerts, and Program Policy and Guidance Directives which further clarify this information.

3.2.a.iii.a Office of Airport Safety and Standards

A staff wildlife biologist is assigned to the Office of Airport Safety and Standards, Washington DC. The biologist works with airport operators and certificate holders through the FAA regional and district offices in matters related to wildlife hazards at airports. Responsibilities of the staff wildlife biologist include: reviewing development plans for certificated airports to minimize wildlife hazards; managing the wildlife aircraft strike database designed to document the history of reported strikes at airports throughout the United States and its territories; and serving as an internal consultant to the FAA regarding the appropriateness of Wildlife Hazard Management Plans, wildlife hazard research, and other wildlife management issues of concern to the FAA.

The FAA staff wildlife biologist examines all wildlife aircraft strike reports submitted to the FAA. Copies of significant strike reports (see Chapter 6 and 14 CFR 139.337[a][1-3]), together with the strike history for the particular airport, are forwarded to the appropriate FAA regional personnel. See also FAA, Office of Airport Safety and Standards' Policies and Program Guidance Policy No. 64, *Review of Airport Wildlife Hazard Management Plans* (Appendix D).

3.2.a.iii.b Wildlife Hazard Assessments

Certificated airports are required by regulation to conduct an Ecological Study[2] when specific wildlife events occur as discussed in Chapter 6 (14 CFR 139.337[a][1-3]). FAA, Office of Airport Safety and Standards' Program Policy and Guidance No. 53 (Appendix D) establishes the procedures that FAA Airport Certification Safety Inspectors should follow when it is determined that an airport needs to conduct a Wildlife Hazard Assessment. Under terms of the Memorandum of Understanding between the FAA and U.S. Department of Agriculture, Wildlife Services (USDA/WS, Appendix G), the USDA/WS program can provide assistance with the conduct of Wildlife Hazard Assessments and the development of Wildlife Hazard Management Plans. FAA Office of Airport Safety and Standards' Certalert No. 97-02 (Appendix E) further clarifies the roles of, and relationship between the FAA and USDA/WS with regard to wildlife hazards on or near airports. See Chapter 6 for a discussion of the contents of a Wildlife Hazard Assessment.

[2] USDA, Wildlife Services, uses the term “Wildlife Hazard Assessment." 14 CFR 139.337(a) uses the term "Ecological Study." In this context the two terms should be considered synonymous. Wildlife Hazard Assessment is the preferred term because it is more descriptive of what is actually being done.

3.2.a.iii.c Wildlife Hazard Management Plans

The FAA considers the Wildlife Hazard Assessment, aeronautical activity at the airport, views of the airport operator and its users, and other pertinent factors in determining whether or not a Wildlife Hazard Management Plan is needed (14 CFR 139.337[c][1-5]). See Chapter 6 for a discussion of the contents of a Wildlife Hazard Management Plan.

3.2.a.iii.d Advisory Circulars, Policy Statements, and Certalerts

Advisory Circulars (ACs) are issued to provide guidance and information in a designated subject area or to show a method acceptable to the Administrator for complying with a related Federal Aviation Regulation. The FAA issues ACs to inform the aviation public in a systematic way of non-regulatory material. Unless incorporated into a regulation by reference, the contents of an AC are not binding on the public.

Policy Statements provide FAA headquarters' guidance on interpretation of the regulatory requirements and provide background on the meaning of sections of the regulations.

Certalerts provide timely information to Airport Certification Safety Inspectors and airport operators on a broad range of safety and airport certification related subjects. They are advisory in nature, non-directive, and have no regulatory authority.

FAA Advisory Circulars, Policy Statements, and Certalerts germane to airport wildlife issues can be found in Appendices C, D, and E, respectively.

3.2.b U.S. Department of Agriculture/Wildlife Services

3.2.b.i Mission

The mission of U.S. Department of Agriculture/Wildlife Services (USDA/WS) is to provide federal leadership in managing problems caused by wildlife. USDA/WS helps manage wildlife to reduce damage to agriculture, natural resources and property; minimizes potential threats to human health and safety; and assists in the protection of threatened and endangered species.

USDA, Wildlife Services personnel will provide assistance in evaluating and reducing wildlife hazards at and in the vicinity of airports. (Photo by E. C. Cleary, FAA)

3.2.b.ii Authority

The primary statutory authority for the USDA/WS program is the Animal Damage Control Act of 2 March 1931, as amended (7 U.S.C. 426-426c; 46 Statute 1468)(See Appendix B).

USDA/WS has the authority to manage migratory bird damage only as specified in the Code of Federal Regulations and under permits issued by the U.S. Fish and Wildlife Service (USFWS) (50 CFR 21). USDA/WS does not have the authority to issue migratory bird depredation permits.

3.2.b.iii Role and Responsibility

Wildlife is a public resource greatly valued by the citizens of the USA. However, wildlife can cause damage to agricultural and industrial resources, pose risks to human health and safety, and impact other natural resources. USDA/WS has the federal responsibility to help resolve conflicts that occur when human activity and wildlife are in proximity to one another. USDA/WS has primary responsibility of responding to threats caused by migratory birds.

ADC Directive 2.305, Wildlife Hazards to Aviation, (Appendix F) provides guidance for USDA/WS wildlife biologists in providing technical assistance or direct control to airport managers, state aviation agencies, the aviation industry, the FAA, and the Department of Defense (DOD) regarding hazards caused by wildlife to airport safety.

USDA/WS assists federal, state, and local agencies, airport managers, the aviation industry, and the military in reducing wildlife hazards on and in the vicinity of airports and air bases according to the Memoranda of Understanding with FAA and Department of Defense, and guidelines published elsewhere.

In addition, it is the responsibility of USDA/WS personnel that observe existing or potential wildlife hazards at airports or air bases to immediately notify the appropriate aviation authorities.

USDA/WS may enter into cooperative agreements to develop Wildlife Hazard Assessments, Wildlife Hazard Management Plans, and to conduct direct wildlife hazard reduction programs. These activities are performed pursuant to agreements that are funded by cooperating entities.

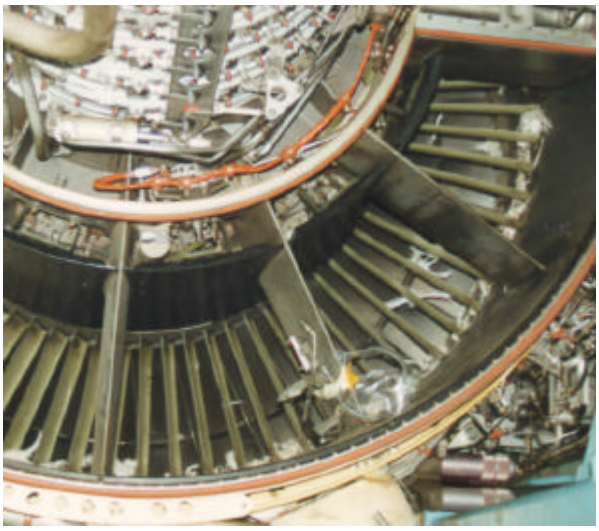
USDA/WS biologists may provide training for airport and air base personnel in wildlife hazard identification and the safe and proper use of wildlife control equipment and techniques.

USDA/WS biologists may provide recommendations and assistance to airport managers and air base commanders in obtaining federal, state, and local permits to remove protected wildlife species.

3.2.c U.S. Department of Defense

3.2.c.i Mission

The Department of Defense (DOD) is responsible for providing the military forces needed to deter war and protect the security of the United States.



A gull was ingested into this engine on a USAF KC-10 aircraft during taxiing. The engine, although not damaged, had to be disassembled and inspected. (Photo courtesy NTSB)

3.2.c.ii Authority

The DOD is the successor agency to the National Military Establishment created by the National Security Act of 1947 (50 U.S.C. 401). It was established as an executive department of the Government by the National Security Act Amendments of 1949 with the Secretary of Defense as its head (5 U.S.C. 101). The DOD's primary authority is established under 32 CFR 1-2900.

3.2.c.iii Role and Responsibility

Each military department (Department of the Navy includes the U.S. Marine Corps) is separately organized under its own Secretary and functions under the authority, direction, and control of the Secretary of Defense. The commanders of unified and specified combat commands are responsible to the President and the Secretary of Defense for accomplishing the military missions assigned to them and exercising command authority over forces assigned to them.

The U.S. Air Force's (USAF) Bird Aircraft Strike Hazard (BASH) Team, HQ Air Force Safety Center, Kirtland Air Force Base, New Mexico, oversees the USAF wildlife strike reduction efforts. The BASH team maintains a wildlife strike database for strikes involving USAF aircraft (www.afsc.saia.af/mil/AFSC/Bash) similar to the database maintained by the FAA for civil aircraft (Chapter 2).

3.2.d U.S. Environmental Protection Agency

3.2.d.i Mission

The mission of the U.S. Environmental Protection Agency (USEPA) is to safeguard the nation's environment.

3.2.d.ii Authority

The USEPA was established in 1970 in response to concerns about polluted air and rivers, unsafe drinking water, endangered species, and waste disposal. The USEPA's primary regulatory responsibilities are established under 40 CFR 1-799.

Landfills often attract birds, such as these turkey vultures, that pose hazards to aircraft. The USEPA requires that certain landfills be operated in a manner that does not pose a bird hazard to aircraft (see Chapter 4). (Photo by E. A. LeBoeuf, USAF)

3.2.d.iii Role and Responsibility

USEPA functions include setting and enforcing environmental standards and regulations related to air and water pollution, hazardous wastes, pesticides and toxic substances. The USEPA's mission is accomplished through partnerships with state and local governments. USEPA responsibilities include pesticide registration and regulation, siting and construction of wastewater treatment and solid waste disposal facilities, which are permitted through state and local agencies. FAA and USDA/WS may be consulted by airport authorities or state and local agencies to review impacts of proposed USEPA-regulated projects on aviation safety.

3.2.d.iii.a Landfills

Approval or disapproval of a landfill site is the responsibility of the USEPA, state and local governing bodies, and zoning boards. Other federal agencies, such as the FAA, may only comment as to whether or not they would consider the proposed landfill to be compatible or non-compatible with their mission requirements.

3.2.d.iii.b Pesticides

Before any pesticide may be used, it must be registered with the USEPA, and with the appropriate state pesticide regulating authority. Pesticides are generally classified as either restricted use or general use. Restricted-use pesticides may only be sold to and used by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification. There are few restrictions on who may purchase or use general use pesticides. Persons who want to use

restricted-use pesticides, or apply any pesticide to the land of another, or apply any pesticides for hire must be a Certified Applicator, or working under their direct supervision, and then may only use pesticides covered by the Certified Applicator's certification (see state EPA below).

3.2.e U.S. Department of Interior/Fish and Wildlife Service

3.2.e.i Mission

The mission of the U.S. Fish and Wildlife Service (USFWS) is to conserve, protect, and enhance the nation's fish and wildlife and their habitats for the continuing benefit of all people.

The resident Canada goose population in the USA more than tripled from 1985-1998 to almost 3 million birds. These geese are extremely adaptive and readily establish nesting territories on golf courses, urban ponds, airports or even flat roofs. From 1990 to 1998, geese were involved in 19% of all reported bird strikes that caused damage. (Photo by E. C. Cleary,

3.2.e.ii Authority

The USFWS has management authority for migratory birds and federally listed threatened and endangered wildlife species. The USFWS primary regulatory responsibilities are established under 50 CFR 1-199.

3.2.e.iii Role and Responsibility

The USFWS is responsible for the conservation and enhancement of migratory birds, threatened and endangered species, certain marine mammals, freshwater and anadromous fishes, and wetlands. The USFWS also manages the National Wildlife Refuge System, enforces federal wildlife laws, and conducts biological reviews of the environmental impacts of development projects.

The USFWS renders biological opinions on proposed federal activities that may impact federally listed or proposed endangered or threatened species, or result in the destruction or adverse modification of designated or proposed critical habitat. These opinions are solicited through a "Section 7 consultation" as required under the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Statute 884, as amended).

3.2.f U.S. Army Corps of Engineers

3.2.f.i Mission

The U.S. Army Corps of Engineers (COE) is charged with a wide range of water resources related functions. Among these are the protection of navigation and safeguarding the nation's water resources.

This C-141 struck numerous herring gulls during takeoff from Travis AFB, California, 20 January 1993. The plane suffered $175,000 in damage. (Photo courtesy USAF)

3.2.f.ii Authority

Regulatory authorities of the COE include Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) which prohibits the obstruction or alteration of navigable waters of the U.S. without a COE permit; Section 404 of the Clean Water Act (33 U.S.C. 1344) which regulates the excavation and discharge of dredged or fill materials into waters of the U.S.; and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 which regulates deposition of fill material into ocean waters.

3.2.f.iii Role and Responsibility

The COE regulatory branch administers a permit system under Section 404 of the Clean Water Act. All proposed management actions involving any wetland habitat modification or excavation of fill material from or discharged into waters of the U.S. must be evaluated for Section 404 applicability and permit requirements. Projects requiring permits may require mitigation for impacted resources.

3.3 STATE AGENCIES

Specific state regulations and their enforcement are not addressed in this manual because of their wide variability. The following general comments are provided as background information.

State and local regulatory agencies that should be consulted when working with airport wildlife issues are those with jurisdiction over wildlife and natural resources, environmental protection, health, law enforcement, transportation and others, as applicable.

3.3.a State Wildlife Management Agencies

It may be necessary to obtain both a federal and a state Wildlife Depredation Permit before taking any migratory birds as part of an airport wildlife management program. (Photo by E. C. Cleary, FAA)

Wildlife management authority for resident nonmigratory birds, terrestrial mammals, freshwater fish, amphibians, and reptiles rests with state wildlife management agencies. These agencies establish the take and possession regulations for all state-protected species. States set their migratory game-bird hunting seasons and bag limits within the guidelines established by the USFWS. States also may list certain wildlife and plant species as threatened or endangered that are not considered as such at the federal level.

Persons needing to take state-protected species outside of the legal hunting season or beyond the established bag limits to promote airport safety must first secure a state depredation permit. Contact the nearest USDA/WS office (Appendix A) for assistance in obtaining any necessary state depredation permits.

3.3.b State Environmental Protection Agencies

3.3.b.i Landfill Siting Permits, Inspections

With concurrence from the USEPA, state EPAs and local governing bodies have the final responsibility for issuing landfill permits. It is also a state responsibility to inspect all landfills to insure compliance with all applicable federal and state regulations.

3.3.b.ii Pesticide Registration

Before a pesticide may be sold or used, it must be registered with the USEPA and with the respective state's pesticide regulatory agency. Special Local Need (SLN) registered pesticides may only be used in the state, and in some cases the specific geographical location, for which the SLN registration has been issued.

3.3.b.iii Pesticide Applicator Licensing

With USEPA concurrence, each state is responsible for establishing pesticide applicator licensing requirements and applicator training procedures. The retail sale and use of restricted use pesticides is limited to Certified Applicators or persons working under their direct supervision and only for those uses covered by the Certified Applicator's certification.

Any person who uses restricted-use pesticides, applies any pesticides for hire, or applies any pesticide to the land of another, must be a Certified Applicator or working under the direct supervision of a Certified Applicator and may only use pesticides covered by the Certified Applicator's certification.

3.4 AIRPORTS

3.4.a Airport Operator

The operator of a certificated airport must demonstrate that the airport is properly and adequately equipped and programs are in place to provide a safe airport-operating environment in accordance with all sections of 14 CFR 139 subpart D. Included in this regulation is the need to address wildlife hazard issues, conduct Wildlife Hazard Assessments, and develop Wildlife Hazard Management Plans as conditions dictate.

Airport operators must take immediate action to eliminate wildlife hazards any time they are detected. (Photo by E. A. LeBoeuf, USAF)

Notwithstanding other requirements, each certificate holder must take immediate measures to alleviate wildlife hazards whenever they are detected (14 CFR 139.337(f)). The airport operator should establish procedures for airport employees or tenants to report hazardous wildlife on or near aircraft movement areas to the appropriate airport personnel.

3.4.b Air Traffic Control

To the extent permitted by higher priority duties and other circumstances, air traffic controllers are required to:

- Issue advisory information on pilot-reported, tower-reported, or radar-observed and pilot-verified bird activity;
- Relay bird activity information to adjacent facilities and to Flight Service Stations (FSS) whenever it appears the wildlife hazard will become a factor in their area. (FAA Order 7110.65, 2-1-22)

3.4.c Pilots

Pilots have a responsibility to report all unsafe conditions on or near an airport, including birds or other wildlife that could pose a threat to aircraft safety. Pilots and other airline or airport personnel should report all known wildlife strikes. Strikes can be reported by completing and mailing FAA Form 5200-7 *Bird/Other Wildlife Strike Report*

(Appendix G). No postage is required if this form is mailed within the United States. This form may be duplicated as needed. Strikes can also be reported electronically at **http://www.faa.gov/arp/birdstrike**. All strike reports are closely screened and edited to prevent duplicate entries in the database.

3.5 BIRD STRIKE COMMITTEE - USA

Bird Strike Committee-USA (BSC-USA) was formed in 1991 to facilitate the exchange of information, promote the collection and analysis of accurate wildlife strike data, promote the development of new technologies for reducing wildlife hazards, promote professionalism in wildlife management programs at airports through training and advocacy of high standards of conduct of airport biologists and bird patrol personnel, and be a liaison to similar organizations in other countries.

Bird Strike Committee USA is directed by an 8-person steering committee consisting of 2 members each from the FAA, USDA/WS, DOD, and the aviation industry's Wildlife Hazards Working Group. The organization meets annually in conjunction with Bird Strike Committee Canada (BSCC). The meeting site alternates between Canada and the USA. There are generally 4 parts to a BSC-USA/BSCC meeting. Part 1 consists of presentations of papers or reports. Part 2 is a vendor and poster session. Part 3 is a training session on wildlife control at airports which covers both civil and military aviation. Part 4 is a field trip which generally covers the host airport and areas off the airport which pertain to aviation or aviation safety. Participation in the annual meetings is open to any person interested in reducing wildlife hazards to aviation and in wildlife management at airports. BSC-USA does not charge membership fees; however, a nominal registration fee is charged for attendance at annual meetings.

This pilot suffered severe head lacerations when a gull penetrated the canopy of his aircraft shortly after takeoff from a California airport, November 1998. (Photo by J. R. Dodd, Airport Manager)

Additional information about BSC-USA can be found at BSC-USA's web site: http://www.birdstrike.org.

CHAPTER 4

FEDERAL REGULATIONS AND DEPARTMENTAL POLICIES IMPACTING AIRPORT WILDLIFE MANAGEMENT

During low level operations near Cannon AFB, New Mexico, 20 December 1985, this F-111 struck a red-tailed hawk, shattering the composite radome. The plane suffered $165,000 in damage. (Photo courtesy USAF)

4.1 INTRODUCTION

Wildlife is often protected by overlapping federal, state, and local laws, regulations, and ordinances that are enforced by a diversity of governmental organizations. Chapter 3 provided an overview of the roles and responsibilities of the various agencies. This chapter will discuss some of the more important federal regulations and departmental policies that influence wildlife management at or near airports.

4.2 SUMMARY OF APPLICABLE FEDERAL REGULATIONS

This engine cowling was damaged by fan blades after a Canada goose was ingested into the engine during takeoff of a Boeing-747 at an airport in New York, 1984. (Photo by USDA)

4.2.a Title 14, Code of Federal Regulations, Part 139

14 CFR 139 governs the certification and operation of land airports which serve any scheduled or unscheduled passenger operation of an air carrier aircraft as covered under part 139. Part 139.337 speaks specifically to the airport operator's responsibilities when dealing with the reduction of wildlife strike hazards on and around airports. A detailed discussion of Part 139.337 can be found in Chapter 6.

4.2.b Title 40, Code of Federal Regulations, Part 258.10

The U.S. Environmental Protection Agency (USEPA), recognizing that birds can be attracted in large numbers to municipal solid waste landfills (MSWLF), and recognizing the potential threat posed by birds to aircraft safety, requires owners or operators of new MSWLF units, or lateral expansions of existing MSWLF units that are located within 10,000 feet of any airport runway used by turbojet aircraft or within 5,000 feet of any airport runway used only by piston-type aircraft, to demonstrate successfully that such units do not create hazardous conditions for aircraft.

The USEPA also requires any operator proposing a new or expanded waste disposal operation within 5 miles of a runway end to notify the appropriate FAA Regional Airports Division Office and the airport operator of the proposal.

4.2.c Title 50, Code of Federal Regulations, Parts 1 to 199

These regulations govern the management of federally protected wildlife within the United States and its territories, and are based on the authority established in the Migratory Bird Treaty Act (see below). These regulations also establish procedures for issuing permits to take federally protected species. In general, a federal depredation permit, issued by the U.S. Fish and Wildlife Service (USFWS), must be obtained before

any non-game migratory birds may be taken, or before any migratory game birds may be taken outside of the normal hunting season or beyond established bag limits.

Federal law protects all migratory birds, including nests and eggs:

- "A migratory bird [is]…any bird whatever its origin and whether or not raised in captivity, which belongs to a species listed in sect. 10.13 [of 50 CFR] or which is a mutation or a hybrid of any such species, including any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consist, or is composed in whole or part, of any such bird, or any part, nest, or egg there of." (50 CFR 10.12). This list includes almost all native bird species in the United States, with the exception of nonmigratory game birds such as pheasants, turkeys and grouse. Exotic and feral species such as mute swans, graylag geese, muscovy ducks, European starlings, house (English) sparrows, and rock doves (pigeons) also are not listed in 50 CFR 10.13 and are therefore not protected by federal law.

Migratory birds as well as any product made from the birds' feathers, nests, or eggs may not be possessed without the appropriate federal permits. This drum, made from adult golden eagle tail feathers, was confiscated by the USFWS. (Photo courtesy National Fish and Wildlife Forensics Laboratory)

In addition to federal protection, all states protect migratory birds as well as resident game birds such as pheasants, turkeys, grouse and partridges. States may or may not protect exotic or feral species.

With the exception of federally listed or proposed threatened or endangered species, federal law does not protect terrestrial mammals, reptiles or other wildlife taxa (e.g., deer, coyotes, raccoons, woodchucks, alligators). Protection of these wildlife groups is left to the various states.

4.2.c.i Depredation Permitting Requirements and Procedures

Persons wishing to take migratory birds, nests, or eggs as part of an airport wildlife management program must first secure a depredation permit from the USFWS. Some state wildlife management agencies may require that a state permit be obtained also. Persons wishing to take state-protected species must first secure a permit from their respective state wildlife management agency. For assistance in obtaining federal and

state depredation permits, contact the local U.S. Department of Agriculture, Wildlife Services (USDA/WS) office (Appendix A).

4.2.c.ii Standing Depredation Orders

Federal law does allow people to protect themselves and their property from damage caused by migratory birds, provided no effort is made to kill or capture the birds:

A federal permit is required to harass threatened or endangered species, as well as bald and golden eagles, from airports. This juvenile bald eagle had to be live-trapped and relocated. (Photo by E. C. Cleary, FAA)

- "No permit is required to merely scare or herd depredating migratory birds other than endangered or threatened species or bald or golden eagles." (50 CFR 21.41)

In addition, certain species of migratory birds may be killed or captured without a federal permit under specific circumstances, most of which relate to agricultural situations. A Standing Depredating Order that has applicability at airports relates to blackbirds and related species:

- "A federal permit shall not be required to control yellow-headed, red-winged, rusty and Brewer's blackbird, cowbirds, all grackles, crows, and magpies, when found committing or about to commit depredation upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance…" (50 CFR 21.43).

However, state laws may not mirror federal law in this respect. For example, in Ohio crows may not be taken outside of the state crow-hunting season without a state-issued depredation permit, and blackbirds may not be killed on Sundays.

Persons wishing to take any other migratory birds, or to take migratory birds in situations other than those described above, must first secure a federal Migratory Bird Depredation Permit from the USFWS and, in some cases, a State Depredation Permit. The first step in obtaining the necessary permits is to contact the nearest USDA/WS state office (Appendix A).

4.2.d The Migratory Bird Treaty Act of 1918, as Amended (U.S. Code 603-711; 40 Statute 755)

The United States of America, Canada, the United Mexican States, Russia and Japan are signatories to the Migratory Bird Treaty Act (MBTA). This act provides the statutory foundation for the federal protection and management of migratory birds in the United States (50 CFR, Parts 1-199).

4.2.e The Animal Damage Control Act of 2 March 1931, as Amended (7 U.S. Code 426-426c; 46 Statute 1468)

This act authorizes and directs the Secretary of Agriculture to manage wildlife injurious to agricultural interests, other wildlife, or human health and safety, including wildlife hazards to aviation (Appendix B). USDA/WS is the agency that carries out this mandate. USDA/WS, because of the experience, training and background of its personnel, is recognized throughout the world for expertise in dealing with wildlife damage management issues. USDA/WS has an active presence in all U.S. states and territories. USDA/WS also has a National Wildlife Research Center in Colorado and 8 regional research field stations.

4.2.f Federal Insecticide, Fungicide, and Rodenticide Act, as Amended (7 U.S. Code 136; Public Law 104.317)

This act, administered by USEPA, governs the registration, labeling, classification, and use of pesticides. Any substance used as a pesticide must be registered with the USEPA and with the respective state pesticide-regulatory agency. Anyone wishing to use restricted-use pesticides, applying any pesticides to the land of another, or applying any pesticides for hire, must be a Certified Applicator, or working under the direct supervision of a Certified Applicator, and then may only use pesticides covered by the Certified Applicator's certification.

4.3 DEPARTMENTAL POLICIES

4.3.a FAA, Airports Division: Advisory Circular 150/5200-33. *Hazardous Wildlife Attractants on or near Airports*

This Advisory Circular (AC) provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports. It also provides guidance

Habitat attractive to wildlife, such as shown in this photo at a mid-western U.S. airport, should be eliminated. (Photo by E. C. Cleary,

concerning the placement of new airport development projects (including airport construction, expansion, and renovation) pertaining to aircraft movement in the vicinity of hazardous wildlife attractants (Appendix C).

4.3.b FAA, Airports Division: Policies and Program Guidance Related to Airport Wildlife Management (Appendix D)

4.3.b.i Initiation of Ecological Studies at Airports: Airport Certification Program, Program Policy and Guidance, Policy No. 53 establishes the procedures FAA Airport Certification Safety Inspectors should follow when it is determined that an airport needs to conduct an ecological study[1] (Wildlife Hazard Assessment) to address an airport wildlife hazard.

4.3.b.ii Section 7 Consultation on Endangered or Threatened Species: Airport Certification Program, Program Policy and Guidance, Policy No. 57 establishes the procedures for coordinating and documenting FAA compliance with the Endangered Species Act when requiring an airport operator to develop, submit for approval, and implement a Wildlife Hazard Management Plan.

4.3.b.iii Review of Airport Wildlife Hazard Management Plans: Airport Certification Program, Program Policy and Guidance, Policy No. 64 establishes the procedures to be followed when an incident occurs that would initiate an ecological study (Wildlife Hazard Assessment) under 14 CFR 139.337(a)(1-3), and directs Airport Certification Safety Inspectors to review an airport's Wildlife Hazard Management Plan to insure that it meets all requirements of Part 14 CFR 139.337(e), as part of their preparation for a certification inspection.

The FAA must be notified before landfill development or expansion can occur within 5 miles of an airport. (Photo by R. A. Dolbeer, USDA)

4.3.b.iv Waste Disposal Facility Coordination: Airport Certification Program, Program Policy and Guidance, Policy No. 65 establishes the procedures for coordinating and documenting FAA determinations on developing new, or expanding existing waste disposal sites within 5 miles of a public-use airport.

[1] USDA, Wildlife Services, uses the term "Wildlife Hazard Assessment." 14 CFR 139.337(a) uses the term "Ecological Study." In this context the two terms should be considered synonymous. Wildlife Hazard Assessment is the preferred term because it is more descriptive of what is actually being done.

4.3.c FAA, Airports Division: Certalerts Relating to Airport Wildlife Management (Appendix E)

4.3.c.i The Relationship Between FAA and USDA/WS: FAA, Office of Airport Safety and Standards, Certalert No. 97-02, clarifies the roles of, and relationship between the Federal Aviation Administration (FAA) and the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services with regards to wildlife hazards on or near airports.

4.3.c.ii Wildlife Hazard Management Plan Outline: FAA, Office of Airport Safety and Standards, Certalert No. 97-09, was issued because an increasing number of questions were being received concerning the preparation and content of an FAA-approved airport Wildlife Hazard Management Plan. This Certalert provides a detailed outline, based on 14 CFR 139.337, of what a Wildlife Hazard Management Plan must address for FAA approval and inclusion in an Airport's Certification Manual. Chapter 6 contains a detailed discussion of this section.

4.3.c.iii Grasses Attractive to Hazardous Wildlife: FAA, Office of Airport Safety and Standards, Certalert No. 98-05, was issued because of reports of airport owners or airport contractors planting disturbed areas (construction sites, re-grading projects, etc.) with seed mixtures containing brown-top millet. All millets are a major attractant to doves and other seed eating birds that may pose a strike hazard to aircraft.

4.3.d USDA, Wildlife Services Directive 2.305, Wildlife Hazards to Aviation (Appendix F)

This directive provides general guidelines for USDA/WS technical and direct control assistance to airport managers, state aviation agencies, aviation industry, FAA, and Department of Defense regarding hazards caused by wildlife to airport safety.

4.3.e Memorandum of Understanding: FAA and USDA/WS (Appendix G)

A Memorandum of Understanding between the FAA and USDA/WS (No. 12-14-71-0003-MOU), establishing a cooperative relationship between the two agencies, has been in effect since 1989. The FAA relies heavily on the assistance of USDA/WS for resolving problems involving wildlife hazards to aviation.

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CHAPTER 5

RECOGNIZING HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS

A Bell Jet Ranger 206-B helicopter struck this turkey vulture at an altitude of 600 feet. The bird penetrated the helicopter just below the squash plate. (Photo by Sgt. R. Ream, Michigan State Police)

5.1 INTRODUCTION

Land use practices and habitats are the key factors that determine the species of wildlife and the size of populations attracted to airport environments. The recognition and control of those land-use practices and habitats on or near airports that attract hazardous wildlife are fundamental to effective Wildlife Hazard Management Plans.

5.2 SEPARATION CRITERIA

The FAA, (through Advisory Circular [AC] 150/5200-33, *Hazardous Wildlife Attractants on or Near Airports* [Appendix C]) recommends maintaining separation between known hazardous wildlife attractants and airport aircraft movement areas, loading ramps, or aircraft parking areas. The minimum recommended distances are:

5.2.a Airports Serving Piston-powered Aircraft

A distance of 5,000 feet is recommended.

5.2.b Airports Serving Turbine-powered Aircraft

A distance of 10,000 feet is recommended.

5.2.c Approach or Departure Airspace

A distance of 5 statute miles is recommended if the wildlife attractant may cause hazardous wildlife movement into or across the approach or departure airspace.

5.3 WASTE DISPOSAL OPERATIONS

5.3.a Municipal Solid Waste Landfills

Municipal solid waste landfills are major attractants to wildlife, especially gulls and turkey vultures. Over 10,000 gulls were counted at this New York City landfill in 1987. (Photo by E. C. Cleary, FAA)

Municipal solid waste landfills attract hazardous wildlife, especially birds. These operations, when located within the separations identified in AC 150/5200-33 (see above and Appendix C) are incompatible with safe airport operations.

5.3.b Enclosed Trash Transfer Stations

Enclosed waste-handling facilities which receive garbage indoors, process it via compaction, incineration, or similar manner, and remove all residue by enclosed vehicles, generally are compatible, from a wildlife perspective, with safe airport operations, provided they are not located on airport property or within the runway protection zone (RPZ). At these facilities, no putrescible waste should be handled or stored outside at any time, or in a partially enclosed structure accessible to hazardous wildlife.

Partially enclosed operations that accept putrescible waste are considered to be incompatible with safe airport operations. FAA recommends these operations occur outside the separations identified in AC 150/5200-33 (see above and Appendix C).

5.3.c Recycling Centers

Recycling centers that accept previously sorted, non-food items such as glass, newspaper, cardboard, or aluminum are, in most cases, not attractive to hazardous wildlife.

5.3.d Composting Operations

Yard-waste compost facilities generally do not attract bird species hazardous to aircraft. However, compost piles should be turned frequently to prevent population build-ups of commensal rodents such as Norway rats, which in turn can attract hawks and owls. (Photo by R. A. Dolbeer, USDA)

Composting operations which accept only yard waste (e.g., leaves, lawn clippings, branches) generally do not attract hazardous wildlife. However, yard-waste composting operations should not be located closer than the greater of the following distances: 1,200 feet from any aircraft movement area, loading ramp or aircraft parking space; or the distance called for by airport design requirements. This spacing is intended to prevent material, personnel, or equipment from penetrating any Object Free Area (OFA), Obstacle Free Zone (OFZ), Threshold Siting Surface (TSS), or Clearway (see FAA AC 150/5300-13, *Airport Design*). Components of the compost should never include food or other municipal solid waste. Sewage sludge, wood-chips, and similar material are not municipal solid wastes and may be used as compost bulking agents. If composting is located on airport property, these operations should be monitored to ensure that steam or thermal rise does not affect air traffic. Discarded leaf disposal bags or other debris must not be allowed to blow onto active airport areas. Also, the airport operator should reserve the right to stop any compost operation that creates unsafe, undesirable, or incompatible conditions at the airport.

5.3.e Fly Ash

The incinerated residue from power/heat-generating facilities, which are fired by municipal solid waste, coal or wood, is generally considered not to be a wildlife attractant because it contains no putrescible matter. Landfills accepting only fly ash are generally not considered to be wildlife attractants. These landfills should be maintained in an orderly manner, admit no putrescible waste of any kind, and not be co-located with other disposal operations that attract hazardous wildlife.

Since varying degrees of waste consumption are associated with general incineration, the ash from general incinerators is considered to be a regular waste disposal by-product and, therefore, a hazardous wildlife attractant if located within the separation criteria outlined AC 150/5200-33 (see above and Appendix C).

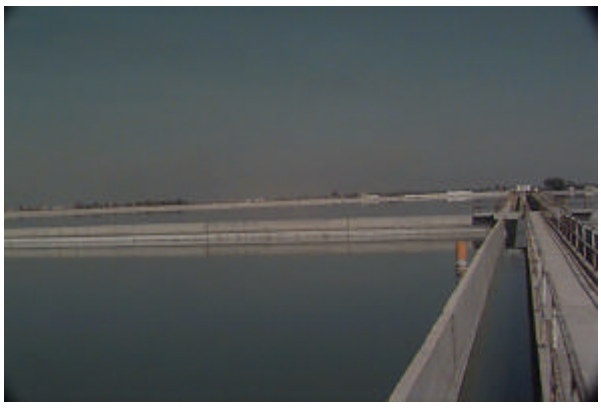
5.3.f Construction and Demolition (C&D) Debris Landfills

C&D landfills are not considered to be hazardous wildlife attractants, if those landfills are maintained in an orderly manner, admit no putrescible waste, and are not co-located with other disposal operations.

C&D landfills have visual and operational characteristics similar to putrescible-waste disposal sites. When co-located with putrescible-waste disposal operations, the probability of hazardous wildlife attraction to C&D landfills increases because of the similarities between these disposal activities.

5.4 WASTEWATER TREATMENT FACILITIES.

Wastewater treatment facilities and associated settling ponds sometimes attract large numbers of birds that can pose a threat to aircraft safety when they are located on or near an airport.



Sewage treatment plants attract birds. About 3,000 ducks, mainly northern shovelers, were feeding at this sewage lagoon near Mexico City, February 1999. (Photo by E. C. Cleary, FAA)

5.4.a New Wastewater Treatment Facilities

Wastewater treatment facilities or associated settling ponds should not be constructed closer than the separations identified in AC 150/5200-33 (see above and Appendix C). During the siting analysis for wastewater treatment facilities, the potential to attract hazardous wildlife should be considered if an airport is in the vicinity of a proposed site.

Airport operators should voice their opposition to such sitings. In addition, airport operators should consider the existence of wastewater treatment facilities when evaluating proposed sites for new airport development projects and avoid such sites when practicable.

5.4.b Existing Wastewater Treatment Facilities

Existing treatment facilities located on or near airports should incorporate appropriate wildlife hazard mitigation techniques (Chapter 9) to minimize use by hazardous wildlife.

5.4.c Artificial Marshes

Wetland sites designed to use submergent or emergent aquatic vegetation as natural filters may be attractive to some species of flocking birds, such as blackbirds and waterfowl, for nesting, feeding and roosting activities. Such artificial marshes should not be established within the separations identified in AC 150/5200-33 (see above and Appendix C).

5.4.d Wastewater Discharge and Sludge Disposal

Disposal of wastewater and sludge should not occur on airport property. Regular spraying of wastewater or sludge disposal on unpaved areas may improve soil moisture and quality. The resultant turf growth requires more frequent mowing, which in turn may expose insects and small mammals. The exposed organisms serve as a food source for hazardous wildlife such as gulls, starlings and raptors. In addition, the improved turf may attract grazing wildlife such as deer and geese.

Problems may also occur when discharges saturate unpaved airport areas. The resultant soft, muddy conditions can severely restrict or prevent emergency vehicles from reaching accident sites in a timely manner.

5.4.e Underwater Waste Discharge

Underwater discharge of any food or other putrescible waste (e.g., fish processing offal) that could attract scavenging wildlife such as gulls is not recommended within the separations identified in AC 150/5200-33 (see above and Appendix C).

5.5 WETLANDS

5.5.a Wetlands on or near Airports

Airport operators with wetlands located on or near airport property should be alert to any wildlife use or habitat changes in these areas which could affect safe aircraft operations.

New airport development should take place in areas where wetlands are outside the separations identified in AC 150/5200-33 (see above and Appendix C) whenever practical. Where alternative sites are not practicable, or when expanding existing airports in or near wetlands, the wildlife hazards should be evaluated and minimized through a wildlife management plan. The plan should be prepared by a wildlife damage management biologist, in consultation with the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (COE). If questions exist as to the status of an area as a wetland, contact the COE, the Natural Resource Conservation Service, or a wetland consultant certified to delineate wetlands.

5.5.b Wetland Mitigation

Creation, enhancement, restoration or, in rare cases, preservation of wetlands may be necessary when unavoidable wetland disturbances result from airport development projects. Wetland mitigation should be designed to avoid creating wildlife hazards.

Recognizing the ecological importance of wetlands, the U. S. Government has established a national policy of no net wetland losses. Wetlands perform a variety of ecologically important functions, such as flood control, water filtration, and wildlife and fish production. (Photo courtesy USDA)

Wetland mitigation projects which may attract hazardous wildlife should be sited outside of the separations identified in AC 150/5200-33 (see above and Appendix C). Wetland mitigation banks meeting these siting criteria offer an ecologically sound approach to mitigation in these situations. Wetland banks are developed to restore, enhance, create or, in rare cases, preserve wetlands to mitigate unavoidable wetland impacts before they occur. Appendix L provides more information on wetland banking and FAA guidance on using that mitigation alternative.

Exceptions to locating mitigation activities outside the separations identified in AC 150/5200-33 (see above and Appendix C) may have to be considered if the affected wetlands provide unique ecological functions, such as critical habitat for threatened or endangered species or ground water recharge. Such mitigation must be compatible with safe airport operations. Enhancing such mitigation areas to attract hazardous wildlife should be avoided. The FAA may review on-site mitigation plans to determine compatibility with safe airport operations.

Wetland mitigation projects needed to protect unique wetland functions, and which must be located in the siting criteria identified in AC 150/5200-33 (see above and

Appendix C), should be identified and evaluated by a wildlife damage management biologist before implementing the mitigation. A plan should be developed to reduce the attractiveness of the wetland area to species hazardous to aviation safety.

5.6 DREDGE SPOIL CONTAINMENT AREAS

Dredge spoil containment areas should be located outside of the separations identified in AC 150/5200-33 (see above and Appendix C) if the design of the containment area is such that it would be attractive to hazardous wildlife or if the spoil contains material that would attract hazardous wildlife. Any dredge spoil containment area to be located in the siting criteria identified in AC 150/5200-33 should be evaluated by a wildlife damage management biologist before construction begins. A plan should be developed to reduce the attractiveness of the site to species that are hazardous to aviation safety.

5.7 AGRICULTURAL PRACTICES

5.7.a Crop Production

Airport operators sometimes promote revenue-generating activities to supplement an airport's income. A common concurrent use is agricultural crop production. Such use may create hazards to aircraft by attracting wildlife. Any proposed on-airport agricultural operations should be reviewed by a wildlife damage management biologist. Cereal grain and sunflower production should not occur on airport property and should be discouraged within the separations identified in AC 150/5200-33 (see above and Appendix C).

Agricultural practices, such as sunflower production (left) and livestock feedlots (right), are inherently attractive to a variety of flocking birds and should be discouraged if they are within 2 miles of an airport. (Photos courtesy USDA)

If a problem with hazardous wildlife develops, a wildlife damage management biologist should be contacted and an on-site inspection conducted. The biologist should determine the source of the hazardous wildlife attraction and suggest remedial action.

Regardless of the source of the attraction, prompt remedial actions to protect aviation safety is required. The remedial actions may range from choosing another crop or farming technique to complete termination of the agricultural operation.

Any post-harvest crop residues that are attractive to foraging wildlife should be plowed under. This requirement should be written into all on-airport farm use contracts and clearly understood by the lessee.

5.7.b Livestock Production

Confined livestock operations (i.e. feed lots, dairy operations, hog or chicken production facilities, egg laying operations) often attract flocking birds such as starlings that may pose a hazard to aviation. Therefore, these facilities should be discouraged within the separations identified in AC 150/5200-33 (see above and Appendix C). Any livestock operation within the above separations should have a program developed to reduce the attractiveness of the site to species that are hazardous to aviation safety.

Free-ranging livestock should not be grazed on airport property because of the danger of their wandering onto aircraft movement areas. Additionally, birds may be attracted to livestock feed, water and manure.

5.7.c Fish Production (Aquaculture)

Fish production facilities using ponds or raceways are inherently attractive to a variety of fish-eating birds (e.g., herons, gulls, osprey) that may pose hazards to aviation safety. Therefore, these facilities should be discouraged within the separations identified in AC 150/5200-33 (see above and Appendix C). Any fish production facility within the above separations should have a program developed to reduce the attractiveness of the site to species that are hazardous to aviation safety.

CHAPTER 6

DEVELOPMENT OF AIRPORT WILDLIFE CONTROL PROGRAMS

This engine on a Boeing-737 sustained major damage when a female eider duck was ingested during landing at an airport in Maine, November 1995. (Photo courtesy National Transportation Safety

6.1 INTRODUCTION

In recognition of the increased risk of serious aircraft damage or the loss of human life that can result from a wildlife strike, greater emphasis is being placed on preparing airport Wildlife Hazard Management Plans that effectively deal with the problem. This heightened awareness and increased effort has raised many questions concerning the preparation and content of a Federal Aviation Administration (FAA)-approved Wildlife Hazard Management Plan for an airport. The specific events that trigger an ecological study[1] (Wildlife Hazard Assessment) and the specific issues that a Wildlife Hazard Management Plan must address for FAA approval and inclusion in the Airport's

[1]USDA, Wildlife Services, uses the term "Wildlife Hazard Assessment." 14 CFR 139.337(a) uses the term "Ecological Study." In this context the two terms should be considered synonymous. Wildlife Hazard Assessment is the preferred term because it is more descriptive of what is actually being done.

Certification Manual (ACM) are presented in Title 14, Code of Federal Regulations, part 139.337 (14 CFR 139.337).

It is important to note that regardless of whether or not a Wildlife Hazard Assessment has ever been required or a Wildlife Hazard Management Plan has been developed, airport operators must be ready to deal with hazardous wildlife on or near the airport. The airport sponsor or manager must be prepared to take immediate action to deal with unexpected incursions of hazardous wildlife into aircraft movement areas, loading ramps, or parking areas (14 CFR 139.337[f]).

6.2 WILDLIFE HAZARD ASSESSMENT

The first step in preparing an airport Wildlife Hazard Management Plan is to conduct a Wildlife Hazard Assessment. The Wildlife Hazard Assessment, conducted by a wildlife damage management biologist, provides the scientific basis for the development, implementation, and refinement of a Wildlife Hazard Management Plan. Though parts of the Wildlife Hazard Assessment may be incorporated directly into the Wildlife Hazard Management Plan, they are two separate documents.

There should be zero tolerance for Canada geese and other large birds at airports. (Photo by R. A. Dolbeer, USDA)

6.2.a Requirement for Wildlife Hazard Assessment

Title 14 CFR 139.337 requires the certificate holder to conduct a Wildlife Hazard Assessment acceptable to the FAA Administrator when any of the following events occur on or near the airport:

1. An air carrier aircraft experiences a multiple bird strike or engine ingestion;

2. An air carrier aircraft experiences a damaging collision with wildlife other than birds;

3. Wildlife of a size or in numbers capable of causing an event described in paragraph (1) or (2) is observed to have access to any airport flight pattern or movement area.

Title 14 CFR 139.337(a)(1-3) details the events that trigger a Wildlife Hazard Assessment. The following provides a point by point comment on the regulations concerning the events that trigger a Wildlife Hazard Assessment.

14 CFR 139.337	Comments
139.337 (a) Each certificate holder shall … conduct an ecological study … when any of the following occurs on or near the airport.	
139.337 (a) (1) An air carrier aircraft experiences a multiple bird strike or engine ingestion.	If more than one bird is struck or if any bird(s) are ingested, an ecological study (Wildlife Hazard Assessment) is required.
139.337 (a) (2) An air carrier aircraft experiences a damaging collision with wildlife other than birds.	Aircraft collision with bats, deer, coyotes, woodchucks, alligators, etc. results in any aircraft damage.
139.337 (a) (3) Wildlife of a size or in numbers capable of causing an event described in paragraph (a) (1) or (2) of this section is observed to have access to the airport flight pattern or movement area.	Airports with a standing Notice to Airmen (NOTAM), announcements on their Automatic Terminal Information Service (ATIS), or comments in Airport/Facility Directory (A/FD) warning of wildlife hazards on or near the airport meet this condition.

6.2.b Necessary Elements of a Wildlife Hazard Assessment

Title 14 CFR 139.337 (b)(1-4) provides specific guidance as to what facts must be addressed in a Wildlife Hazard Assessment. The following is a point by point comment on each section of the regulations concerning the factors must be addressed in a Wildlife Hazard Assessment.

14 CFR 139.337	Comments
139.337 (b) The study required in paragraph (a) of this section shall contain at least the following:	
139.337 (b) (1) Analysis of the event which prompted the study.	What happened – who, what, when, where, why?
139.337 (b) (2) Identification of the species, number, locations, local movements, and daily and seasonal occurrence of wildlife observed.	What species of wildlife have access to the airport? What are their legal status, movement patterns, and seasonal patterns?

14 CFR 139.337	Comments
139.337 (b) (3) Identification and location of features on and near the airport that attract wildlife.	Wildlife are attracted to an airport because something exists on or near the airport that they desire, such as large open areas where they can loaf in relative safety; abundant food or water; escape, loafing, or nesting cover. These attractants need to be identified and evaluated.
139.337 (b) (4) Description of the wildlife hazards to air carrier operations.	This is a judgment call best made by a professional wildlife management biologist, trained in dealing with airport issues. Hitting 3-4 swallows is much less hazardous than hitting one 12-pound Canada goose (see Table 7-1).
Recommendations for mitigating identified hazardous wildlife attractants.	Although not currently required by regulations, it is very helpful if the biologist preparing the Wildlife Hazard Assessment provides *prioritized* recommendations for mitigating the hazardous wildlife attractants identified in 139.337(b)(3).

6.3 WILDLIFE HAZARD MANAGEMENT PLAN

6.3.a Requirement for Wildlife Hazard Management Plan

The FAA will consider the results of the Wildlife Hazard Assessment, along with the aeronautical activity at the airport and the views of the certificate holder and airport users, in determining whether or not a formal Wildlife Hazard Management Plan is needed (14 CFR 139.337 [c]). At a minimum, it is recommended that the airport manager develop and implement a plan to deal with any hazardous wildlife attractants or situations identified in the Wildlife Hazard Assessment.

If the FAA determines that a Wildlife Hazard Management Plan is needed, the certificate holder must then formulate and implement a Wildlife Hazard Management Plan, using

Collisions with aircraft are not the only problem caused by birds at airports. Here, starlings have built their nest in an aircraft's wing. As part of the Wildlife Hazard Management Plan, aircraft owners and maintenance personnel should be reminded to carefully inspect any aircraft regularly parked outside. (Photo courtesy USDA)

the Wildlife Hazard Assessment as the basis for the plan (14 CFR 139.337 [d]). At the same time, the FAA regional coordinator will contact the local U.S. Fish and Wildlife Service (USFWS), Ecological Services Field Office and request information concerning the presence of federally listed or proposed endangered or threatened species or designated or proposed critical habitat on or near the airport (See FAA Airport Certification Program, Program Policy and Guidance No. 57, Section 7 Consultation on Endangered or Threatened Species, Appendix D.) The USFWS response will be forwarded to the airport operator to be taken into account when preparing the required plan.

If federally listed or proposed endangered or threatened species or designated or proposed critical habitat are present, the airport operator must prepare a Biological Assessment (50 CFR 402.13) assessing the impacts of the Wildlife Hazard Management Plan on these species or habitats. The Biological Assessment and draft Wildlife Hazard Management Plan must be submitted to FAA for review and approval.

Airport management may request the wildlife biologist who prepared the Wildlife Hazard Assessment to assist with the preparation of the Wildlife Hazard Management Plan and to review the finished plan. However, ultimate responsibility for the development and implementation of the plan rests with the airport operator. When the plan is completed the airport operator must submit the draft plan, together with a copy of the Biological Assessment, to the FAA for approval. The FAA will conduct any needed Section 7 consultations with the USFWS. Once approved, the plan becomes part of the Airport's Certification Manual and is enforceable.

Low spots on pavement and other airside areas that collect rainwater are highly attractive to birds. Improving drainage to eliminate such areas should be part of an airport's wildlife hazard management efforts. (Photo by R. A. Dolbeer, USDA)

6.3.b Necessary Elements of a Wildlife Hazard Management Plan.

The goal of an airport Wildlife Hazard Management Plan is to minimize wildlife populations on and around the airport that pose a threat to aviation safety or to structures, equipment and human health. The Wildlife Hazard Management Plan should address the following:

- Identify those responsible for implementing the plan,
- Identify and provide information on hazardous wildlife attractants on or near the airport,
- Identify appropriate wildlife management techniques to minimize the wildlife hazard,
- Prioritize appropriate management measures,
- Recommend necessary equipment and supplies, and
- Identify training requirements for the airport personnel who will implement the Wildlife Hazard Management Plan.

It is often helpful for the airport manager to appoint a Wildlife Hazards Working Group that periodically reviews the airport's Wildlife Hazard Management Plan and the plan's implementation to make recommendations for further refinements or modifications (see Chapter 8).

Title 14 CFR 139.337 (e) and (f) provide specific guidance as to what facts must be addressed in a Wildlife Hazard Management Plan. The following details how requirements of Part 139.337 (e) and (f) should be addressed in an FAA-approved Wildlife Hazard Management Plan (see also Appendix E).

14 CFR 139.337	Comments
139.337(e). The Wildlife Hazard Management Plan shall include at least the following :	
139.337(e)(1). The persons who have authority and responsibility for implementing the plan.	Specific responsibilities for various sections of the Wildlife Hazard Management Plan must be assigned or delegated to various airport departments such as: Airport Director Operations Dept. Maintenance Dept. Security Dept. Planning Dept. Finance Dept. Wildlife Coordinator Wildlife Hazards Working Group Local law enforcement authorities that provide wildlife law enforcement and other support having a role to play are: U.S. Fish and Wildlife Service State wildlife agency City police County Sheriff

14 CFR 139.337	Comments
139.337(e)(2). Priorities for needed habitat modification and changes in land use identified in the ecological study (Wildlife Hazard Assessment) with target dates for completion.	Provide list of attractants (food, cover, and water) identified in Wildlife Hazard Assessment, with priorities for mitigation and completion dates. Attractants can be grouped by areas and ownership. (A list of completed habitat modification projects designed to reduce the wildlife strike potential can be included to provide a history of work already accomplished). Airport property: Aircraft Operations Area (AOA) Within 2 miles of aircraft movement areas (AMA) Airport structures Non-airport property: Within 2 miles of AMA Within 5 miles of AMA
Habitat/population management recommendations	Specific management plans for particular areas, attractants, species, or situations, as identified in the Wildlife Hazard Assessment. This section may include any or all of the following: Food/Prey Management: Rodents Earthworms Insects Grain/seeds Garbage – handling, storage Handouts (feeding wildlife) Habitat Management Vegetation Management AOA vegetation Drainage ditch vegetation Landscaping Agriculture Water Management Permanent Water Wetlands Canals/ditches

14 CFR 139.337	Comments
(Continued) Habitat/population management recommendations	Holding ponds Sewage (glycol) treatment ponds Other water areas Ephemeral water Runways, taxiways, aprons Other wet areas Airport buildings Airfield structures Abandoned structures Terminal Airport construction Resource Protection Exclusion Repelling Chemical Auditory Visual Species-specific population management plans (e.g., deer, gulls, geese, and coyotes). These plans should address: Habitat modification Repelling Exclusion Removal
139.337(e)(3). Requirements for and, where applicable, copies of local, state and federal wildlife control permits.	Certain species of wildlife may be protected at all levels of government – local, state, federal, or may not be protected at all, depending on location and species. Therefore, the section should address the specific species involved and their legal status. The wildlife management permitting requirements and procedures should be described and address all levels of government having jurisdiction, i.e. Federal – 50 CFR parts 1 to 199. State – Fish and Game Code (or equivalent) City, county – ordinances

14 CFR 139.337	Comments
(Continued) 139.337(e)(3). Requirements for and, where applicable, copies of local, state and federal wildlife control permits.	If pesticides are to be used, the following are also needed: Pesticide use regulations: Federal- (FIFRA)] State (varies by state) Pesticide-use licensing requirements State regulations
139.337(e)(4). Identification of resources to be provided by the certificate holder for implementation of the plan.	Lists identifying what the airport will supply in terms of: Personnel Time Equipment (e.g., radios vehicles, guns, and traps). Supplies (e.g., pyrotechnics) Pesticides Restricted/non-restricted Application equipment Sources of Supply
139.337(e)(5). Procedures to be followed during air carrier operations, including at least:	
139.337(e)(5)(i). Assignment of personnel responsibilities for implementing the procedures;	Who, when, what circumstances Wildlife Control Personnel Wildlife Coordinator Operations Dept. Maintenance Dept. Security Dept. Air Traffic Control
139.337(e)(5)(ii). Conduct of physical inspections of the movement areas and other areas critical to wildlife hazard management sufficiently in advance of air carrier operations to allow time for wildlife controls to be effective;	Who, when, how, what circumstances Runway, taxiway sweeps AOA monitoring Other areas attractive to wildlife
139.337(e)(5(iii)). Wildlife control measures;	Who, what circumstances, when, how are Wildlife Control Personnel contacted? What methods are to be used to: Repel Capture Kill

14 CFR 139.337	Comments
139.337(e)(5)(iv). Communication between wildlife control personnel and any air traffic control tower in operation at the airport.	Training in communication procedures Equipment needed Radios, cellular phones, lights
139.337(e)(6). Periodic evaluation and review of the Wildlife Hazard Management Plan for:	At a minimum, the airport operator should hold annual meetings, or after an event described in 139.337(a)(1 to 3), with representatives from all airport departments involved in wildlife hazard management efforts and the wildlife damage management biologist who did the original ecological study (Wildlife Hazard Assessment).
139.337(e)(6)(i). Effectiveness in dealing with the wildlife hazard;	Input from all airport departments, Air Traffic Control (ATC), and the wildlife biologist, as to effectiveness of the plan. Good records are required for evaluating the effectiveness of a program (see Chapter 8).
139.337(e)(6)(ii). Indications that the existence of the wildlife hazard, as previously described in the ecological study (Wildlife Hazard Assessment), should be reevaluated.	For example: Number of times wildlife seen on AOA. Requests for wildlife dispersal from ATC, pilots, or others. Increased number of strikes.
139.337(e)(7). A training program to provide airport personnel with the knowledge and skills needed to carry out the Wildlife Hazard Management Plan required by paragraph (d) of this section.	Training for: Wildlife Control Personnel. Other airport personnel. Pesticide user training and certification. (see Chapter 7)

14 CFR 139.337	Comments
139.337(f). Notwithstanding the other requirements of this section, each certificate holder shall take immediate measures to alleviate wildlife hazards whenever they are detected.	Although not required as part of Wildlife Hazard Management Plan, the following information should be included to fulfill Part 139 requirements: Procedures and responsibilities for notifying the following regarding new or immediate wildlife hazards by and to: Wildlife Control Personnel Operations NOTAM issuance/cancellation criteria and procedures. Maintenance Security Air Traffic Control Others Responsibilities for implementing rapid response procedures for new or immediate hazards: Wildlife Control Personnel Operations Maintenance Security Air Traffic Control Others
139.337(g). FAA Advisory Circulars in the 150 series contain standards and procedures for wildlife hazard management at airports that are acceptable to the Administrator.	AC 150/5200-33 *Hazardous Wildlife Attractants on or Near Airports*.

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CHAPTER 7

WILDLIFE HAZARD MANAGEMENT TRAINING FOR AIRPORT PERSONNEL

This engine on a Boeing-747 was damaged by ingesting a Lappet-faced vulture *upon departure from Nairobi, Kenya, January 1998. (Photo by R. A. Dolbeer, USDA)*

7.1 INTRODUCTION

The management of wildlife is a complex endeavor. Once a Wildlife Hazard Management Plan is in place, the plan must be implemented by well-trained and knowledgeable individuals to be successful.

Depending on the size of an airport and the level of wildlife hazard, the Wildlife Hazard Management Plan may be implemented by a single airport employee undertaking wildlife control activities on an occasional “as needed” basis or by a full-time wildlife biologist with a staff of operations personnel providing continuous bird patrols. Many of the personnel involved in these control activities, hereafter referred to as Wildlife Control Personnel (WCP), may have no formal education in wildlife biology. However, all WCP should have sufficient training to be knowledgeable in the basic principles of wildlife management and in the identification, behavior, general life history and legal status of the hazardous species in the area. WCP also must be trained in the proper implementation or deployment of the various control strategies and techniques outlined in the Wildlife Hazard Management Plan. Finally, an awareness of endangered and threatened wildlife species which may visit or reside at the airport is critical.

Table 7-1 Ranking of 21 wildlife species or species groups by relative hazard to civil aircraft based on percent of reported strikes causing damage or effect-on-flight, 1991-1997. This list does not factor in the relative abundance of species groups which will vary greatly among airports. For a given airport, a low-ranking species group with a high population may actually pose more of a hazard than a high-ranking group that is rarely present (from Dolbeer et al. unpublished manuscript).

	Composite ranking[a]	Relative hazard score[b]
Deer (all species)	1	100
Vultures (black & turkey)	2	63
Geese (all species)	3	52
Osprey	4	50
Sandhill cranes	5	48
Pelicans (white & brown)	6	44
Ducks (all species)	7	37
Eagles (bald & golden)	8	31
Hawks (buteos)	9	25
Rock dove (pigeon)	10	24
Gulls (all species)	11	22
Herons (all species)	12	22
Coyote	13	20
Mourning dove	14	17
Owls (all species)	15	16
American kestrel	16	14
Shorebirds (all species)	17	12
Crows/ravens (all species)	18	12
Blackbirds/starling (all species)	19	9
Sparrows (misc. small birds)	20	4
Swallows (all species)	21	2

[a] 1 = most hazardous species group; 21= least hazardous group.

[b] Relative hazard risk based on sum of percent of strikes by species group causing damage or effect-on-flight scaled downward from 100 (with 100 being score for species group with maximum summed values).

7.2 TRAINING

The following areas of training and levels of skill are suggested for WCP implementing control activities at airports under a Wildlife Hazard Management Plan. It is emphasized that, once a plan is in place, in addition to the training provided to the WCP, there should be periodic oversight and review of the plan and its implementation by a professional biologist trained in wildlife damage control (14 CFR 139.337 [e][6]).

7.2.a Bird Identification

There are over 600 species of birds that reside in, or migrate through, the United States. Many of these species, such as gulls, have quite different plumage patterns and bill colors as subadults (year of hatching up to 3 years in some species) than as adults (as an example, see Appendix I for a fact sheet on North American gulls). Some birds, such as laughing gulls, European starlings and black-bellied plovers, have different summer and winter plumage patterns and bill colors. In other species, such as northern harriers and red-winged blackbirds, males and females appear quite different. Some species are present in an area all year, others only in migration (spring, fall), and others only in winter or in summer. All species have unique vocalizations, behaviors, and habitat preferences that are useful in field identification. Thus, to become an expert in field identification of all bird species at a location requires many years of training and practice.

Certain species of waterfowl will occasionally hybridize (e.g., this mallard/northern pintail cross), making their offspring difficult to identify without professional assistance. (Photo by E. C. Cleary, FAA)

WCP should have basic training so that they can identify, in all plumages, common birds on the airport that are hazardous to aviation. Table 7-1 provides a list of the relative hazard of various species groups based on the percent of reported strikes that cause damage or an effect-on-flight. WCP also should be able to identify those rarer species that are considered hazardous when present or are of concern because of endangered-species status.

Binoculars are essential for detailed, close-up observations sometimes necessary for identification as well as for the detection and identification of birds or other wildlife at a distance. WCP should have binoculars available and be trained in their use.

Each WCP should have his or her own bird identification field guide, which should be carried in the vehicle while on patrol. As a learning aid, WCP should be encouraged to

make annotations in their field guides regarding behavior or appearance next to identified birds.

There are a number of excellent field guides available from bookstores, some of which are listed at the end of this chapter. There are also bird identification guides available on CD ROM which provide useful life-history information and vocalizations.

7.2.b Mammal Identification

Unlike birds, there are typically only a few mammal species of importance on an airport. WCP should be able to identify, not only by sight but also by sign (e.g., tracks, burrows, and fecal material), the common large and mid-sized mammals (e.g., deer, raccoons, woodchucks, coyotes) that live around the airport. WCP should also be able to identify signs (e.g., trails in grass, burrows) indicative of a population eruption of field rodents such as voles or rats. A survey by a biologist using snap traps may be necessary to identify the exact species of rodents using airport habitat.

Field rodents are strong attractants to birds of prey. The assistance of a professional wildlife biologist may be necessary to identify the rodents using airport habitat. (Photo by E. C. Cleary, FAA)

Burt and Grossenheider (1998) is a good general field guide covering mammals throughout the United States (full citation at end of Chapter). In addition, there are many state and regional field guides for identifying mammals and their signs. Each airport should have a mammal field guide in its wildlife library.

7.2.c Basic Life Histories and Behavior of Common Species

In addition to learning to identify the hazardous birds and mammals on the airport, WCP should have some understanding of the biology and behavior of these species. This information will make the job of wildlife hazard management more interesting as well as be useful in anticipating problems and deploying control measures more effectively.

For each species of bird, it is important to know if the species is present year-round or only in summer, winter, or during migration. For example, in which habitats and at what time of year do locally breeding bird species nest and when are young fledged? What are the daily movement patterns between roosting, feeding and loafing areas in relation to the airport? What feeding behaviors and food preferences does the species have on the airport? Which habitats does the species prefer? How does each species react to

approaching aircraft and to various repellent devices? By being observant and noting the behavior of these hazardous species, useful insights may be gained that will lead to more effective habitat management or repellent strategies.

Most bird and mammal field guides provide information on geographic range, feeding habits and habitat preferences for each species. Ehrlich et al. (1988) provide a concise summary of life history information (nesting, feeding, habitat) for most birds in North America. Appendix I provides some life-history facts for various gull species in the United States. Such books and fact sheets provide an excellent starting point for knowledge about a species. However, the most useful information will come from careful observation of what the birds and mammals are doing on your airport.

Remains of a red-tailed hawk struck by an aircraft at an airport in Illinois, 1995. Hawks often are attracted to grassy areas at airports to feed on rodents. (Photo by R. A. Dolbeer, USDA)

7.2.d Wildlife and Environmental Laws and Regulations

As presented in Chapter 4, there is a complexity of federal and state laws protecting wildlife and regulating the issuance of permits to take (capture or kill) individuals causing problems. In addition, environmental laws and regulations regarding pesticide applications, drainage of wetlands, and endangered species must be considered in implementing Wildlife Hazard Management Plans. All WCP should have a basic understanding of the federal Migratory Bird Treaty Act (MBTA) whereby almost all native migratory birds are protected regardless of their abundance (see Chapter 4). WCP should understand that federal and often state permits must be issued before these species can be taken on an airport. WCP should also understand that wild mammals are regulated at the state level, which may require permits for activities involving removal. Non-native birds, such as pigeons, house sparrows and starlings, and gallinaceous game birds, such as turkeys, grouse and pheasants, are not protected by the MBTA but may have state protection. WCP on an airport involved in taking any wildlife species should have a clear understanding of which species have no legal protection and, for all others, the species and numbers allowed to be taken under permits issued. Permits also will list the methods of removal and disposition of removed wildlife.

7.2.e Wildlife Control Techniques

Chapter 9 provides a brief description of most wildlife control techniques used at airports. WCP will need training to deploy these techniques safely and effectively.

Firearms. It is critical that only personnel trained in the use of firearms, authorized under depredation permit, and knowledgeable in field identification of the target and similar-looking nontarget species, are allowed to use firearms on the airport. Skill, experience and the proper equipment are needed to be safe and to maximize the effectiveness of a shooting program, whether it be to remove specific problem animals or to kill 1 or more individuals to reinforce repellent techniques. All discharged shell casings are potential Foreign Object Debris (FOD) and should be picked up.

Pyrotechnics can be a fire, FOD, and human safety hazard if used improperly. Also, birds can quickly habituate to pyrotechnics. Therefore, only trained personnel should use pyrotechnics at an airport. (Photo courtesy USDA)

Pyrotechnics. Pyrotechnics can cause injury or damage if discharged incorrectly or carelessly. For example, serious injuries have occurred when pyrotechnics were accidentally discharged inside vehicles. Proper equipment (safety glasses, ear protection) and training is essential for safe use of pyrotechnics. In addition, training is needed to deploy the correct pyrotechnic for each situation and wildlife species and to minimize habituation. It is critical that pyrotechnics (and other repellent devices) not be deployed in situations where the birds or mammals might be flushed into the path of departing or arriving aircraft.

Pesticide application. WCP applying restricted-use pesticides, applying pesticides for hire, or applying pesticides to the land of another, must be a Certified Applicator, or working under the direct supervision of a Certified Applicator and then may only use pesticides covered by the Certified Applicator's certification. Proper application equipment and safety clothing must be used. Detailed records of pesticide applications must be maintained.

For information on the training requirements for becoming a Certified Pesticide Applicator, contact the State University Cooperative Extension Service.

Distress call tapes, propane cannons and miscellaneous techniques. As emphasized in Chapter 9, a major problem in the use of repellent techniques or devices is habituation of the wildlife species to the threats. These techniques all require training for their proper deployment. The most critical factor for most repellent devices is that they be deployed sparingly and appropriately when the target wildlife is present, and be reinforced occasionally by a real threat such as shooting. More detailed

information on the use of various repellent devices is presented in Chapter 9 and Hygnstrom et al. (1994).

7.2.f Record Keeping and Strike Reporting

A key component of a Wildlife Hazard Management Plan is developing a system to 1) document the daily activities of the WCP, 2) log information about wildlife numbers and behavior on the airport, and 3) record all wildlife strikes with aircraft. This information is essential to document the effort being made by the airport in reducing wildlife hazards. The information is also extremely useful during periodic evaluations of the Wildlife Hazard Management Plan and when revisions to the plan are proposed. All WCP should be instructed on the importance of record keeping and be trained to record this information in a standardized format. Chapter 8 provides more detail about record keeping and wildlife strike reporting.

7.3 SOURCES OF TRAINING

Wildlife control workshops at airports-. Books, manuals and videos can provide a starting point for building skills to manage hazardous wildlife at airports. However, hands-on training is essential to develop the necessary skills and confidence to successfully and safely carry out wildlife control activities. Workshops on Airport Wildlife Control offered by the U.S. Department of Agriculture, Wildlife Services or other entities are an excellent means of obtaining training in wildlife identification, legal issues, and the deployment of various control techniques specific for a given airport or region of the country. These workshops can be held for all WCP at a single airport or at a centralized airport with participants coming from airports throughout the state or region.

Training, provided by recognized experts, should include classroom instruction, fieldwork, and attendance at conferences such as Bird Strike Committee USA, Bird Strike Committee Canada, and AAAE's Airport Wildlife Hazard Workshops. (Photo by E. C. Cleary, FAA)

Contact the Wildlife Services office in your state (Appendix A) for more information.

Bird Strike Committee USA meetings-. Bird Strike Committee USA (BSC-USA) holds joint meetings annually with Bird Strike Committee Canada at a U.S. or Canadian airport. This annual meeting provides an excellent forum to discuss the latest issues and techniques in wildlife control for airports. The meeting includes a field trip to the host airport with demonstrations by vendors and wildlife specialists of various wildlife

control equipment and techniques. Chapter 3 provides more information on BSC-USA. Information on annual meetings, as well as information on various aspects of wildlife hazard management for airports, can be found at BSC-USA's web site: **www.birdstrike.org**.

Hunter safety and firearms courses-. Airport personnel who will be using firearms should complete a hunter safety or firearms safety course. The state wildlife agency can provide information on these courses.

Miscellaneous courses and activities-. Many universities and some community colleges offer courses in ornithology, principles of wildlife management, principles of wildlife damage control or other related topics. Local Audubon Society chapters or park districts sometimes offer workshops or short courses in field identification of birds. Participation in conservation organization activities such as Christmas Bird Counts and spring migration counts is an excellent means of building bird identification skills and developing contacts with local wildlife experts.

7.4 WILDLIFE HAZARD MANAGEMENT LIBRARY

Many species of wildlife have adapted to urban environments, as exemplified by these ring-billed gulls nesting on a roof in Cleveland, Ohio. Airport wildlife control personnel need to monitor areas on and near airports for nesting and roosting populations of birds hazardous to aircraft. Note the ineffectiveness of the owl effigy in frightening the gulls. (Photo by R. A. Dolbeer, USDA)

Every airport with a Wildlife Hazard Management Plan should have a designated location for reference books such as wildlife field guides, videos, posters, and other training and educational materials. Ideally, this wildlife library should be located at the site where information on wildlife control activities and wildlife strikes is entered into logs, files and databases.

7.5 FIELD GUIDES AND REFERENCE BOOKS

There are many excellent field guides and reference books for learning about wildlife. Listed below is a selection of books that cover North America or large regions of the United States. There are also many field guides for individual states and specialized books for various wildlife species or species groups. This list should not be considered an endorsement of these books to the exclusion of others that may be available.

Field Guides - Birds

Bull, J., J. Farrand, Jr., and, L. Hogan. 1994. National Audubon Society field guide to North American birds: Eastern region. Knopf, New York. 796 pages. 2nd edition.

Dunn, J. L., and E. A. Blom. 1999. National Geographic field guide to the birds of North America. National Geographic Society. 464 pages. 3rd edition.

Griggs, J. L. 1997. All the birds of North America: American Bird Conservancy's field guide. HarperCollins. 172 pages.

Peterson, R. T. 1998. A field guide to the birds: a completely new guide to all the birds of Eastern and Central North America. Houghton Mifflin Company, New York. 384 pages. 4th edition.

Peterson, R. T. 1990. A field guide to Western birds: a completely new guide to field marks of all species found in North America west of the 100th meridian and north of Mexico. Houghton Mifflin Company, New York. 431 pages. Reissue edition.

Robbins, C. S., B. Bruun, and H. S. Zim. 1983. Birds of North America. Golden Press, New York. 360 pages.

Field Guides - Mammals

Burt, W. H., and R. P. Grossenheider. 1998. A field guide to the mammals: North America north of Mexico. Houghton Mifflin Company, New York. 3rd edition.

Murie, O. J. 1954. A field guide to animal tracks. Houghton Mifflin Company, New York. 374 pages.

Life Histories

Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The birder's handbook: a field guide to the natural history of North American birds, including all species that regularly breed north of Mexico. Simon and Schuster, New York. 785 pages.

Chapman, J. A., and G. A. Feldhamer (editors). 1982. Wild mammals of North America. Johns Hopkins Univ. Press, Baltimore, MD. 1,147 pages.

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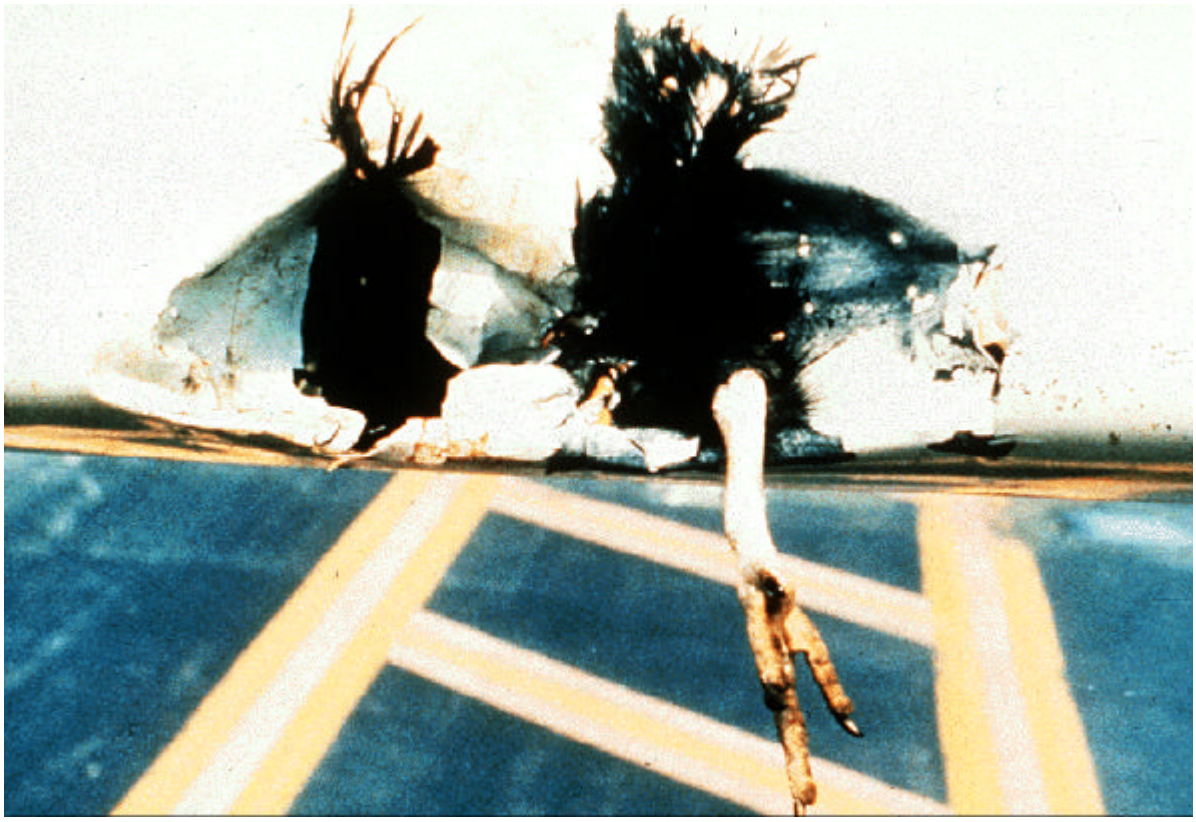
CHAPTER 8

EVALUATING WILDLIFE HAZARD MANAGEMENT PROGRAMS AT AIRPORTS



This is the aftermath of a collision between a C-130 aircraft and a turkey vulture. (Photo courtesy USAF)

8.1 INTRODUCTION

Wildlife populations on and in the vicinity of airports are constantly changing in response to changes in land-use, state and federal management policies, and environmental factors. In addition, wildlife may adapt or habituate to control strategies that were once effective, or they may develop new behavioral or feeding patterns on or near the airport. New wildlife control technologies may become available, or established products or techniques may be withdrawn or banned. Finally, there may be changes in wildlife control and management personnel at an airport. Once a Wildlife Hazard Management Plan is in place, a process must be developed so the plan and the

control programs implemented through the plan can be periodically evaluated and improved (14 CFR 139.337 [e][6]). This chapter outlines a means of such evaluations.

8.2 MONITORING AND RECORD KEEPING

The importance of accurate monitoring and record keeping cannot be overemphasized. Without consistently maintained records of wildlife activity, wildlife strikes and wildlife management actions, the proper evaluation of a program is impossible. Without evaluation, no assessment of the effectiveness of a program can be made. Furthermore, without accurate records and proper evaluation, it may be difficult or impossible to justify and defend certain management actions such as wildlife removal or to defend the airport during litigation in the aftermath of a damaging wildlife strike.

8.2.a Hazard Assessments, Plans, and Studies

As discussed in Chapter 7, each airport should have a designated location for all reference books such as wildlife field guides, videos, posters, and other training and educational materials. Copies of Wildlife Hazard Assessments, Wildlife Hazard Management Plans, and other relevant wildlife studies conducted at the airport should be available at this site for ready reference as needed. Ideally, this wildlife library should be located at the site where information on wildlife control activities and wildlife strikes is entered into logs, files and databases.

8.2.b Daily Log of Wildlife Control Activities

A daily log of wildlife activity and management actions should be maintained. Important factors to record include:

- Date, time and location on the airport where wildlife is observed;
- Species of wildlife and approximate numbers;
- Control actions taken and response of wildlife.

Airport runways, with unobstructed views and sun-warmed surfaces, provide ideal resting sites for birds such as these ring-billed gulls in Ohio, 1998. Bird patrol personnel need to quickly disperse birds that attempt to rest on runways and other airport pavements. (Photo by T. W. Seamans, USDA)

This information ideally should be recorded on a form (see Table 8-1 for example of daily log form) by wildlife control personnel at the site where the activity takes place. If a form is not available, the information may be recorded in a log book at the operations base.

The use of a standardized form or recording format, such as presented in Table 8-1, is strongly recommended. The information recorded will be most useful if it is summarized into monthly and annual statistics (see below). Use of a standardized format allows this summarization to be easily done. The use of computerized database systems customized to provide summaries of wildlife control activities is recommended.

8.2.c Daily Log of Wildlife Strikes

Maintaining a consistent record of wildlife strikes is essential for defining the wildlife hazard level for an airport and for evaluating the airport's Wildlife Hazard Management Plan. In addition to maintaining these strike records for internal use at the airport, the strike reports should be mailed or transmitted electronically to the FAA to be incorporated into the National Wildlife Strike Database (Chapter 2).

Bird remains found within 200 feet of a runway centerline that show signs of interacting with aircraft, such as this laughing gull at an airport in New York in 1991, should be recorded as bird strikes. (Photo by R. A. Dolbeer, USDA)

As defined in the glossary, a wildlife strike is deemed to have occurred when:

1. A pilot reports striking 1 or more birds or other wildlife;

2. Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike;

3. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;

4. Bird or other wildlife remains are found within 200 feet of centerline of a runway, unless another reason for the animal's death is identified;

5. The animal's presence on the airport had a significant negative effect on a flight (e.g., aborted takeoff or landing, high-speed emergency stop, aircraft left pavement area to avoid collision with animal).

Each strike event under categories 1-3 or 5 (reported strike) should be recorded on FAA Form 5200-7 (Appendix H) and mailed to the FAA (the form is pre-addressed and franked on the back side). Send photocopies of the form that do not have the address and frank on the back to:

Federal Aviation Administration
Office of Airport Safety and Standards, AAS-310
800 Independence Avenue, SW
Washington, DC 20591

Copies of this form (with the address and frank) can be downloaded and printed from **www.faa.gov/arp/hazard.htm.** The form also can be filled out and filed electronically at this site.

In filling out FAA Form 5200-7, include as much of the information requested as is available. Typically, not all information requested on the form will be available or known, but the report is valuable even if some information is missing.

For category 4 strikes (wildlife remains found but no report of strike), a log of these incidents should be maintained with the date, location, number and species of animals struck recorded (Table 8-2). A copy of this log should also be mailed to FAA monthly or these strikes should be reported individually on FAA Form 5200-7 with a notation that carcass was found but no strike was reported.

For all strike reports, every effort should be made to have the wildlife correctly identified to species. Species that cannot be readily identified should be frozen in a labeled bag until a local wildlife expert can be consulted. If only feather remains are available, they can be mailed in a sealed plastic bag to the address above for identification. Please include a copy of the strike report or other relevant information with the bird remains to assist the feather experts in identifying the bird.

8.2.d Records of Significant Management Actions Taken

In addition to maintaining a daily log of wildlife control activities and wildlife strikes, it is important to keep records of other preventative management actions that may not be part of the daily routine of wildlife control. Examples of such actions might be installing or repairing fencing, thinning trees, clearing construction debris, applying insecticides or repellents, grass-height management, installing netting in hangars or wires over ponds, and regrading pavement to eliminate standing water. In addition, activities such as writing letters to catering services about proper storage of food waste are also important management actions.

A vegetation cover and mowing regime should be established at airports to minimize rodent populations and the production of seeds, insects, and forage desired by birds. (Photo by R. A. Dolbeer, USDA)

Documenting these activities in some type of summary file or table can aid in determining the total cost and effectiveness of the wildlife control program.

8.2.e Summary Reports by Month and Year

It may be necessary to control field rodents in some airport areas using appropriate rodenticides. This control activity should be recorded in the daily logs and noted on an airport map for future reference. (Photo courtesy USDA)

Information from the log of daily wildlife control activities and log of wildlife strikes should be summarized periodically to provide baseline data for analyzing and evaluating the wildlife control program. A logical approach is to conduct monthly summaries that are then incorporated into an annual report. These summaries do not need to be complex but should reflect the level of activity for the common control techniques deployed. For example, monthly summaries of pyrotechnics fired, runway sweeps to disperse birds and deer, distress call deployments, birds shot by species, and wildlife strikes by species would be useful (Table 8-3). A short paragraph could then outline other significant activities during the month such as repairing a fence or regrading an area to remove standing water. An annual report (Table 8-4) could then be easily developed by combining data from the monthly reports. It is emphasized that Tables 8-3 and 8-4 are only presented as examples to provide guidance in developing a format to summarize data. A particular airport might use methods not listed in Tables 8-3 and 8-4 such as falconry, radio-controlled model airplanes, dogs, or propane cannons. The important point is that there should be an objective, numerical documentation of wildlife control methods deployed and wildlife strikes occurring on the airport. The use of a computer database program can be extremely helpful in producing these summary reports.

8.2.f Training

A record of all training which wildlife control personnel have received should be maintained and summarized annually. This should include attendance at conferences, courses and workshops (e.g., firearms safety), self-study courses, and specialized on-the-job training.

8.3 ASSESSMENT OF WILDLIFE HAZARD MANAGEMENT PLAN

An airport's Wildlife Hazard Management Plan and the implementation of the plan should be reviewed annually by an outside wildlife biologist trained in wildlife damage control. The wildlife biologist might also include a subgroup of people from the Wildlife Hazard Working Group (see below) to assist in the review. Appendix J describes a simple system (modified from Seubert 1994) for assessing a Wildlife Hazard Management Plan at an airport. Five assessment categories are used to indicate the

adequacy of a Wildlife Hazard Management Plan and how well the plan is being implemented:

Category 1. Management functions related to wildlife hazards at or in the vicinity of the airport;

Category 2. Bird control at or in the vicinity of the airport;

Category 3. Mammal control at or in the vicinity of the airport;

Category 4. Management of habitat and food sources on airport property related to wildlife hazards;

Category 5. Land uses and food sources off airport property potentially related to wildlife hazards at the airport.

Within Categories 1-4 (activities on the airport), a series of elements are listed which are evaluated as either “Satisfactory”, “Unsatisfactory”, “Needs Improvement” or “Not Applicable”. For Category 5 (off-airport attractants), the elements are scored on a scale of 0 (not present) to 3 (site creates significant wildlife hazard for airport, action should be taken). Those elements deemed “Unsatisfactory” or “Needs Improvement” (in Categories 1-4) or that are scored 2 or 3 (in Category 5) are then commented on in a summary form. The elements listed within each category are not intended to cover every possibility at every airport. The elements can be modified or expanded to meet situations unique to an airport.

Gulls and other birds are attracted to wetlands such as this depression located 200 feet from the end of a runway at a mid-western U.S. airport. (Photo by R. A. Dolbeer, USDA)

8.4 AIRPORT WILDLIFE HAZARDS WORKING GROUP

8.4.a Function

Wildlife hazard management at an airport often requires communication, cooperation and coordination among various groups on the airport and with various local, state and federal agencies and private entities. For many airports, the establishment of a Wildlife Hazards Working Group (WHWG) will greatly facilitate this communication, cooperation and coordination.

8.4.b Membership

The WHWG should include a representative from each of the key groups and agencies that have a significant involvement or interest in wildlife issues on the airport. Airport groups might include representatives from maintenance, operations, Air Traffic Control (ATC), and any fixed-base operators. Government agencies from outside the airport might include representatives from the state wildlife agency, U.S. Fish and Wildlife Service and USDA, Wildlife Services. Any facility near the airport that significantly attracts wildlife (such as a landfill or wildlife refuge) also should be represented.

An airport's Wildlife Hazard Working Group should meet at least annually or following a strike event that triggers a Wildlife Hazard Assessment (See Chapter 6). (Photo courtesy USDA)

The core WHWG usually should not exceed 10 people to keep meetings from becoming unwieldy. In addition to regular members, people with specialized knowledge, interest or concerns can be invited to meetings as appropriate. Typically, someone from airport management should chair the WHWG, or the chair can be rotated among groups.

8.4.c Meetings

The WHWG should meet at least annually for a general review of the overall wildlife hazard management program for the airport and to discuss special issues or problems as needed. The general review should include discussion of:

- Strike trends and significant strike events (based on data summarized using formats in Tables 8-3 and 8-4);
- Source of wildlife causing strike problems;
- Wildlife control activities (based on data and commentary summarized using formats in Tables 8-3 and 8-4);
- Wildlife Hazard Management Plan evaluation (based on most recent assessment using format in Appendix J).

Special issues to be discussed might include projected impacts of land-use changes on or near the airport, trends in populations or behavior of various species of wildlife,

wildlife removal permits, evaluation of new wildlife control technologies, and clarification of roles and responsibilities. A good way to end the meeting might be with a field demonstration of a control method or other management activity on the airport.

Special meetings of the entire WHWG or a subgroup may be needed after significant strike events or other developments affecting wildlife hazards if a regular meeting is not scheduled for the near future.

8.4.d Meeting Reports

The chairperson of the WHWG should arrange to have minutes or a summary report written for each meeting. This report should contain a list of attendees, decisions made by the group, deadlines and responsible parties for task assignments, and a list of critical issues that were not resolved.

8.5 SUMMARY AND CONCLUSIONS

All airport personnel should be trained to recognize and report wildlife hazards to the appropriate WHWG member. (Photo by E. A. LeBoeuf, USAF)

Periodic evaluations of an airport's Wildlife Hazard Management Plan and the activities undertaken to implement the plan are critical because of the dynamic nature of wildlife hazards and control technologies. The foundation for these evaluations is the maintenance of consistent records of wildlife control activities and wildlife strikes. The use of standardized formats for keeping these records, such as presented in Tables 8-1 to 8-4, permits easy compilation of events and activities into monthly and annual statistical and narrative summaries. Once these summaries are available, objective examinations and comparisons can be made of trends in strikes, wildlife activities, control methods deployed and other factors.

An objective, standardized format for assessing a Wildlife Hazard Management Plan and its implementation is presented in Appendix J. This format allows an outside biologist or group to systematically review the actions being taken and make recommendations in areas where improvement is needed. The availability of summary statistics such as provided through records maintained in Tables 8-1 to 8-4 is essential for this assessment.

Finally, the establishment of a WHWG provides an excellent means of improving communication, coordination, and cooperation among the diverse groups involved in

wildlife hazard management on an airport. The WHWG also can provide an important forum for reviewing, evaluating and improving an airport's wildlife hazard management program.

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Table 8-1. Example of daily log of wildlife control activities.

Airport_____

Date	Time	Location	Wildlife		Control method	Results/comments	Initials
			Species	No.			

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Table 8-2. Example of Wildlife Strike Log for recording bird or other wildlife remains found within 200 feet of runway centerline that, in the judgment of wildlife control personnel, were killed as a result of interacting with an aircraft.

Airport_____

Date	Time found	Species	Runway	Location on runway	Was strike reported?*	Comments

* If strike was reported, FAA Form 5200-7 should be filled out with details.

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Table 8-3. Example of form to provide monthly summary of wildlife control activities.

Airport_____ Month_____

Control activity (modify list as appropriate)	This month	Same month last year	Comments (list wildlife removed by species and method)
No. of pyrotechnics fired			
No. of times distress calls deployed			
No. of runway sweeps to clear birds or other wildlife			
No. of wildlife removed			
Miles driven by wildlife patrol			
No. of reported strikes			
No. of carcasses found (no strike reported)			

Summary paragraph of other wildlife control activities:

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Table 8-4. Example of form to provide annual summary of wildlife control activities derived from monthly reports (Table 8-3). Each airport's form should be modified to reflect the common control activities undertaken during the year.

Airport_____ Year_____

Month	No. of pyrotech-nics fired	No. of times distress calls deployed	No. of runway sweeps to clear birds or other wildlife	No. of wildlife removed[a]	Miles driven by wildlife patrol	No. of reported strikes[b]	No. of carcasses found (no strike reported)[b]	Comments
Jan								
Feb								
Mar								
Apr								
May								
Jun								
Jul								
Aug								
Sep								
Oct								
Nov								
Dec								
Total								

[a] Provide separate list by species and method.

[b] Provide separate list by species.

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CHAPTER 9

WILDLIFE CONTROL STRATEGIES AND TECHNIQUES AT AIRPORTS

This Fokker F-28 struck a red-tailed hawk on final approach to a major California airport, 1996. (Photo by T. C. Hall, USDA)

9.1 INTRODUCTION

No airport or aircraft type is immune from the hazards of wildlife strikes. Many species of birds and mammals have been involved in damaging strikes (Chapter 2). A flock of starlings suddenly rising from the ground, a lone kestrel hovering in search of prey, a pair of Canada geese taking flight after grazing in the infield, or a deer bounding across a runway all may result in significant aircraft damage or in extreme cases, a crash and loss of human lives. In addition to strikes, wildlife that are roosting, nesting or burrowing on airports can cause structural damage to buildings, pavement, equipment and aircraft, as well as nuisance and health problems for workers.

As discussed in Chapters 5 and 6 in the conduct of Wildlife Hazard Assessments and development of Wildlife Hazard Management Plans, the first step in solving any wildlife damage problem is to answer the following questions:

1. What are the wildlife doing which makes controlling their numbers or damage necessary? The answer to this question will, to a large extent, determine the control methods used.

2. Which species of wildlife are causing the problem? Different species require different management techniques.

3. What is the legal status at the federal, state and local levels of the problem wildlife? All wildlife are not afforded equal legal protection by all levels of government.

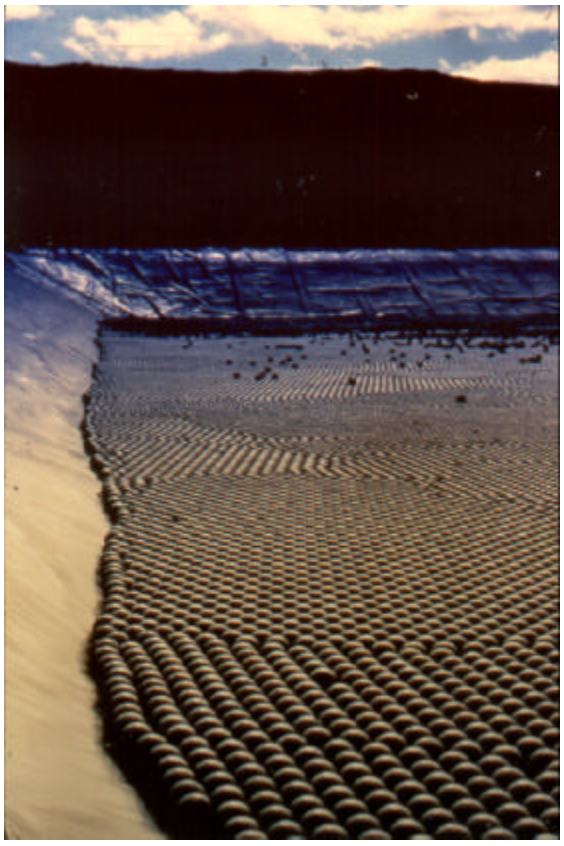
4. What are the daily and seasonal movement patterns of the wildlife among feeding, loafing, and roosting/nesting areas? Try to identify the times of day and seasons of year, as well as locations on airport, where the wildlife pose the most critical threat to aviation safety and where they are most vulnerable to management actions.

5. What effective and legal management methods are available? In wildlife hazard management, effective and legal are not necessarily synonymous.

6. How selective are these control methods? The objective is to control only the target wildlife, not every species in the area.

7. How much will it cost to apply the selected control methods? The cost of control may dictate which methods are practical, given the seriousness of the threat caused by the species.

8. What are public attitudes toward the problem wildlife species and the hazards that these species pose? Public opinion also may influence the type of management actions taken.



Floating plastic balls can be used to cover ponds and prevent birds from using the sites. (Photo courtesy Wildlife Materials, Inc.)

This chapter presents the overall approach that should be taken to manage wildlife hazards at airports. Once the overall approach is established, the chapter

outlines the strengths and weaknesses of various wildlife control methods recommended for use at airports, as well as certain methods that should not be used.

This chapter is not the final word on this subject. Wildlife damage control is a dynamic field, and new products and technologies are continuously being introduced. In addition, changes in the legal status of control techniques, chemical registrations and wildlife species occur at the federal and state level. Thus, this chapter should be viewed as a starting source for information on wildlife control techniques.

Overhead wires, spaced at 10-foot intervals, reduced waterfowl use of this sewage pond near an airport in the eastern U.S. (Photo by L. Terry, USDA)

It is recommended that this chapter be used in conjunction with the two-volume manual "**Prevention and Control of Wildlife Damage**" published in 1994 by Cooperative Extension, University of Nebraska at Lincoln (see full citation at end of this chapter). This manual, written by various experts in the field of wildlife damage control, provides detailed information on the techniques, equipment, chemical registrations, species-specific management recommendations and sources of supply for the various control strategies presented in this chapter. This manual is also available online in a periodically updated version at**: ianrwww.unl.edu/wildlife/solutions/handbook/.**

9.2 WILDLIFE CONTROL STRATEGIES

Four basic control strategies are available to solve wildlife problems at airports:

a. Flight schedule modification;

b. Habitat modification and exclusion;

c. Repellent and harassment techniques;

d. Wildlife removal.

All 4 control strategies should be integrated into the Wildlife Hazard Management Plan as appropriate.

9.2.a Flight Schedule Modification

Although not generally practical for regularly scheduled commercial traffic on larger airports, there may be various situations when flight schedules of some aircraft can be adjusted to minimize the chance of a strike with a wildlife species that has a predictable pattern of movement. For example, pilots could be advised not to depart during a 30-minute period at sunrise or sunset during winter when large flocks of blackbirds cross an airport going to and from an off-airport roosting site. In situations such as at Midway Atoll where albatrosses and other seabirds are abundant during parts of the year, scheduling nighttime arrivals and departures, when birds are not flying, may be the only means of avoiding strikes. Finally, air traffic controllers on occasion may need to temporarily close a runway with unusually high bird activity or a large mammal (e.g., deer) incursion until wildlife control personnel can disperse the animals.

9.2.b Habitat Modification and Exclusion

Habitat modification means changing the environment to make it less attractive or inaccessible to the problem wildlife. All wildlife need food, cover and water to survive. Any action that reduces, eliminates or excludes one or more of these elements will result in a proportional reduction in the wildlife population at the airport.

Initially, management actions to reduce food, cover, and water on an airport may be expensive. However, when costs are amortized over several years, these actions may be the least expensive approach to reduce wildlife populations on the airport. Once a habitat modification is done correctly, it is generally not necessary to go back and do it again. Also, these control methods are generally well accepted by the public and minimize the need to harass or kill wildlife on the airport.

Artificial feeding of waterfowl promotes unnaturally high bird concentrations. This can adversely effect aircraft safety. Feeding wildlife should be prohibited at airports and discouraged in areas near airports. (Photo by E. C. Cleary, FAA)

9.2.b.i Food

Some of the more common urban food sources for birds on and near airports include handouts from people in taxi stands and parks, grain elevators, sewage treatment plants and improperly stored food waste around restaurants and catering services. Rural food sources attractive to birds include sanitary landfills, feedlots, certain agricultural crops (especially cereal grains and sunflower), and spilled grain along road and rail rights-of-way.

Airport operators should be aware of

these food attractants for birds that exist on and in close proximity to the airport. On the airport, operators should require bird-proof storage of food waste, prohibit bird feeding, and promote good sanitation and litter control programs. Agricultural crops attractive to birds, such as cereal grains and sunflower, should be prohibited on airport lands leased for farming within the separation criteria identified in AC 150/5200-33 (see Chapter 5 and Appendix C). For nearby off-airport areas, airport operators should work closely with local governmental entities and landowners to discourage land-use practices and activities that provide food sources for problem bird species.

Trees and other landscaping plants selected for the street side of airports should not produce fruits or seeds attractive to birds. On airside areas, the large expanses of grass and forbs can sometimes provide ideal habitat for rodent and insect populations that attract raptors, gulls, other bird species, and mammalian predators such as coyotes. In addition, grasses allowed to produce seed heads can provide a desirable food source for doves, blackbirds and other species. The management of airside vegetation to minimize rodents, insects and seeds may be complex, requiring insecticide, herbicide and rodenticide applications, changes in vegetation cover, and adjustments in mowing schedules (e.g., mowing at night to minimize bird feeding on insects exposed by the mowing). Such management plans will need to be developed in conjunction with professional wildlife biologists and horticulturists knowledgeable with the local wildlife populations, vegetation and growing conditions (see below).

9.2.b.ii Cover

All wildlife need cover for loafing, roosting, escape, and reproduction. Pigeons, house sparrows, and European starlings use building ledges, abandoned buildings, open girders and bridge work, and dense vegetation for cover. Blackbirds use marsh vegetation such as cattails for nesting and roosting. Many bird problems can be solved by eliminating availability of such areas either through removal or by exclusion.

Giant Canada geese, left undisturbed, will establish territories on urban lakes and ponds. In just a few years a pair of geese can easily increase to a flock of 100 or more. (Photo by E. C. Cleary, FAA)

Care should be taken when selecting and spacing plants for airport landscaping, not only to avoid production of fruits and seeds desired by birds as discussed above, but also to avoid the creation of areas of dense cover for roosting and nesting. Bird roosts that do form in trees on airports can generally be eliminated by thinning the canopy of trees and perhaps selectively removing trees to increase their spacing.

The management of airport airside vegetation to minimize bird activity is a controversial subject in North America. The general recommendation, based on studies in England in the 1960s and 1970s, has been to maintain a monoculture of grass at a height of 6-10 inches (Transport Canada) or 7-14 inches (U.S. Air Force). Tall grass, by interfering with visibility and ground movements, is thought to discourage many species of birds from loafing and feeding. However, the limited studies conducted in North America have not provided a consensus of opinion on the utility of tall-grass management for airports. For example, Canada geese do not appear to be discouraged by tall grass. In addition, maintenance of tall grass may result in increased rodent populations, a food source for raptors. Finally, maintenance of uniform stands of tall grass is difficult on many airports because of varying soil conditions. Arid regions in the western United States cannot maintain tall grass without irrigation.

Regardless of the grass height on the rest of the airport, the grass within the runway and taxiway safety areas should be maintained at a height of 3-4 inches. This will allow airport personnel and Airport Certification Safety Inspectors to visually inspect these areas for ruts, humps, depressions or other surface irregularities.

Until more research is completed, no general guidelines on grass height or vegetation type for airside areas of airports will be made. Airport operators should consult with professional wildlife biologists and horticulturists to develop a vegetation type and mowing schedule that is appropriate for the growing conditions and wildlife at the location. The main principles to follow are to use a vegetation cover and mowing regime that do not result in a build-up of rodent numbers or the production of seeds, forage or insects desired by birds.

Finally, dense stands of trees and undergrowth on airport property can provide excellent cover for deer, coyotes, geese, raptors, roosting blackbirds, rodents, and other wildlife. In general, these habitats should be cleared or at least sufficiently thinned to eliminate the desired cover and to allow easy visual and physical access by wildlife control personnel. All unnecessary posts, fences and other structures that can be used as perches by raptors and other birds should be removed from airside areas. Piles of construction debris and discarded equipment, unmowed

All areas of standing water on the airport operating area should be drained to discourage bird use. (Photo courtesy USAF)

fence rows, and other unmanaged areas often provide excellent cover for commensal rodents (rats and house mice). Such areas should be eliminated from airports.

9.2.b.iii Water

Water acts as a magnet for birds; therefore, all standing water on airports should be eliminated to the greatest extent possible. Depressions in paved and vegetated areas and disturbed areas at construction sites that accumulate standing water after rain should be filled or modified to allow rapid drainage. This is particularly important at coastal airports where fresh water is highly attractive to birds for drinking and bathing. Retention ponds, open drainage ditches, outdoor fountains and other wetland sites should not be established on or adjacent to airports.

9.2.b.iv Exclusion Techniques

If food, water, or cover can not be eliminated by habitat modification, then actions can sometimes be taken to exclude the wildlife from the desired resource. Exclusion involves the use of physical barriers to deny wildlife access to a particular area. As with habitat modification, exclusion techniques, such as installing a covered drainage ditch as opposed to an open ditch, can initially be costly. However, exclusion provides a permanent solution that is not only environmentally friendly, but when amortized over many years, may actually be the least expensive solution.

9.2.b.iv.a Exclusion of Birds

Access to rafter and girded areas in hangars, warehouses, and under bridges can be eliminated with netting. Curtains made of heavy-duty plastic sheeting, cut into 12-inch strips, and hung in warehouse or hangar doorways, can discourage birds from entering these openings. Porcupine wire can be installed on ledges, roof peaks, rafters, signs, posts, and other roosting and perching areas, to keep birds from using them. Changing the angle of building ledges to 45 degrees or more will deter birds from perching.

Birds can be prevented from roosting in hangars, warehouses, and under bridges by screening the rafters (left, photo by E. C. Cleary, FAA). Netting can also be installed over airport ponds to exclude birds (right, photo courtesy Wildlife Materials, Inc.).

Gull and waterfowl use of retention ponds and drainage ditches can be reduced with over-head wire systems. A system of wires spaced 10 feet apart or in a 10- x 10-foot grid will discourage most gulls and waterfowl from landing. Similar wire systems have been successfully used to keep gulls off roofs and out of landfills, and to exclude crows from electrical substations. When it is desirable to eliminate all bird use, netting can be installed over small ponds and similar areas. However, birds are sometimes tangled in the netting, and maintenance problems arise with high winds and freezing weather. Complete coverage of ponds with plastic, 3-inch diameter "bird balls" will completely exclude birds and yet allow evaporation of water. Designing ponds with steep slopes will discourage wading birds such as herons. Use of culverts to totally cover water in drainage ditches is recommended whenever possible.

9.2.b.iv.b Exclusion of Mammals

Airports should have a "zero tolerance" policy for deer, livestock and other large mammals in the aircraft operating area because of their severe threat to aviation safety (see Table 7-1). The best, albeit most costly, procedure for excluding these animals is a permanent, 10-foot high chain-link fence with barbed-wire outriggers that is inspected regularly to fix any holes, wash-out areas or other breaches. This fence also serves as an excellent security barrier for the airport. There are also numerous electric-fence designs for excluding deer, discussed in Hygnstrom et al. (1994), that are not as costly as permanent fencing but have drawbacks in safety and maintenance.

This 5-strand electric fence is one of many designs that can be used to discourage deer and other large mammals from entering selected areas. (Photo by E. C. Cleary, FAA)

Cattle Guards are widely used to prevent hoofed livestock from traversing across fenced areas through permanent openings maintained for vehicular access. These devices, if at least 15 feet in length perpendicular to fence, will prevent deer from entering through gated areas on airports.

9.2.c Repellent Techniques

Repellent and harassment techniques are designed to make the area or resource desired by wildlife unattractive, or to make the wildlife uncomfortable or fearful. Long term, the cost-effectiveness of repelling wildlife usually does not compare favorably with habitat modification or exclusion techniques. No matter how many times wildlife are driven from an area that attracts them, they or other individuals of their species will return as long as the attractant is accessible. However, habitat modifications and

exclusion techniques will never completely rid an airport of problem wildlife; therefore, repellent techniques are a key component of any wildlife hazard management plan.

Gulls and other birds quickly habituate to electronically generated distress calls broadcast from stationary speakers. However, gull distress calls occasionally broadcast from speakers mounted on vehicles, used in combination with pyrotechnics and shooting, can be useful in dispersing gulls at airports. (Photo by R. A. Dolbeer, USDA)

Repellents work by affecting the animal's senses through chemical, auditory, or visual means. Habituation or acclimation of birds and mammals to most repellent techniques is a major problem. When used repeatedly without added reinforcement, wildlife soon learn that the repellent techniques are harmless. The repellents become a part of their "background noise", and they ignore them.

Critical factors to be recognized in deploying repellents are:

1. There are no "silver bullets" that will solve all problems;

2. Likewise, there is no standard protocol or set of procedures that is best for all situations. Repelling wildlife is an art as much as a science. The most important factor is having motivated, trained personnel with the appropriate equipment for their needs who understand the wildlife situation on their airport;

3. Each wildlife species is unique and will often respond differently to various repellent techniques. Even within a group of closely related species such as gulls, the various species will often respond differently to various repellent techniques;

4. Habituation to repellent techniques can be minimized by:

   a) using each technique sparingly and appropriately when the target wildlife is present,

   b) using a variety of repellent techniques in an integrated fashion,

   c) reinforcing repellents with occasional lethal control (with necessary permits in place) directed at abundant problem species such as gulls or geese.

Advances in electronics, remote sensing capabilities, and computers are resulting in the development of "intelligent" systems that can automatically deploy repellents (e.g.,

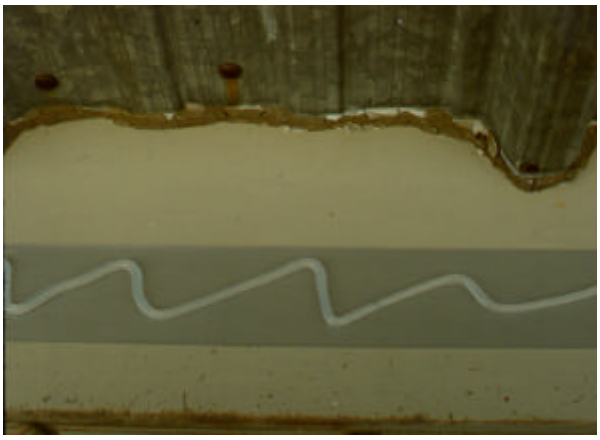
noisemakers, chemical sprays) when targeted wildlife enter a designated area. These devices may help reduce habituation and increase effectiveness of repellents in some situations. However, these devices will never replace the need for trained people on the ground to respond appropriately to incursions by a variety of highly adaptable, sentient wildlife species.

9.2.c.i Wildlife Patrols/Runway Sweeps in Vehicles

Regular patrols of airside areas to disperse birds and other hazardous wildlife are a critical component of an integrated program of wildlife hazard management at airports. Often, driving a vehicle towards the wildlife will be enough to cause the wildlife to disperse, especially if the driver has been deploying repellent and removal techniques as outlined below. Regular patrols and sweeps also permit Wildlife Control Personnel to learn the daily movement patterns, habitat preferences and behavior of wildlife on the airport. This information can be useful in determining wildlife attractants on the airport that need to be removed (e.g., low areas that gather standing water after rains) and in anticipating problem situations. All wildlife carcasses found during runway sweeps should be removed, identified to species and documented on a wildlife strike log for carcass remains (Table 8-2).

9.2.c.ii Chemical Repellents for Birds

Chemical repellents, toxicants and capturing agents must be registered with the U.S. Environmental Protection Agency (USEPA) or Food and Drug Administration (FDA) before they can be used to manage wildlife at airports. Products must also be registered in each state. Hygnstrom et al. (1994) provide a listing of chemical products, by active ingredient and by company name, registered for birds and mammals. The following chemical repellents, listed by active ingredient, are presently available for use at airports.



Applying polybutene anti-perching material over duct tape, rather than directly to ledges or rafters, facilitates cleanup and re-application. (Photo by E. C. Cleary, FAA)

Perching structures (polybutenes). Several commercial products are available in liquid or paste form. These sticky formulations make birds uncomfortable when they alight on them, encouraging the birds to look elsewhere to perch or roost. To be effective, all perching surfaces in a problem area must be treated, or the birds will move a short distance to an untreated surface. Under normal conditions, the effective life of these materials is 6 months to 1 year. Dusty environments can substantially reduce the life expectancy. Once the material loses effectiveness, it is necessary to

remove the old material and apply a fresh coat. Applying the material over duct tape, rather than directly to the building ledge or rafter surface, will facilitate clean up.

Turf feeding (methyl anthranilate, anthraquinone). There are 2 chemicals presently (1999) registered as bird repellents for turf. Methyl anthranilate is an artificial grape flavoring commonly used in foods and beverages. Birds have a taste aversion to methyl anthranilate, apparently reacting in much the same way that mammals react to concentrated ammonia (smelling salts). Methyl anthranilate is registered under commercial formulations as a feeding repellent for geese and other birds on turf (grass). The second repellent, anthraquinone, apparently acts as a conditioned-aversion repellent with birds. Birds ingesting food treated with anthraquinone become slightly ill, developing a post-ingestion aversion to the food. An anthraquinone formulation for repelling geese from turf also is available. Both products are liquid formulations applied by sprayer to the vegetation. Effectiveness of these sprays in repelling geese can be highly variable, depending on growing conditions, rainfall, mowing, and availability of alternate feeding areas. In general, effectiveness will be least (perhaps lasting only a few days) when grass is growing rapidly.

Water (methyl anthranilate). Methyl anthranilate formulations are also available for application to pools of standing water on airports and at other locations to repel birds from drinking and bathing. This application is probably best for temporary pools of water after rainfall, where repellency of only a few days is needed.

Fogging with a methyl anthranilate formulation may help disperse birds, such as tree swallows and killdeer, at airports. (Photo by J. T. Peterla, USDA)

General area (fogging with methyl anthranilate). A methyl anthranilate formulation is also available for use in fogging machines (thermal or mechanical) to disperse birds from hangars, lawns and other areas.

Frightening agent (Avitrol [4-Aminopyridine]). Avitrol is registered for repelling pigeons, house sparrows, blackbirds, grackles, cowbirds, starlings, crows, and gulls from feeding, nesting, loafing, and roosting sites. Birds eating Avitrol-treated baits react with distress symptoms and calls, behaviors that frighten away other birds in the flock. Avitrol, although registered as a “frightening agent”, is lethal to the birds that eat treated baits. Therefore, Avitrol should be treated as a toxicant. Avitrol-treated bait is diluted with untreated bait so that most birds in the flock do not ingest treated bait. The primary use of Avitrol at airports has been in pigeon control around buildings. The use of Avitrol requires knowledge of the feeding patterns of the birds, proper prebaiting procedures to

ensure bait acceptance and avoidance of nontarget species, and removal of dead birds after treatment.

9.2.c.iii Chemical Repellents for Mammals

There are a number of taste and odor repellents marketed to repel deer, rabbits and other mammals from browsing on vegetation (Hygnstrom et al. 1994). These include products that are applied directly to the vegetation and general area (odor) repellents (e.g., predator urine). Some of these products may be appropriate for short-term protection of valuable landscaping plants and fruit trees. However, their use at airports to repel or discourage deer or other mammals is not recommended because they are unlikely to have any influence on wildlife movements in the airport operating area. For example, a recent study showed that predator urines (coyote, bobcat) had no influence on deer movements along established trails or at feeding sites.

9.2.c.iv Audio Repellents for Birds

Propane cannons can be used as part of an integrated program to disperse birds from airports. However, birds quickly habituate to the loud bangs if the cannons are used continuously and not integrated with other frightening devices. (Photo by G. E. Bernhardt, USDA)

Propane cannons. Propane cannons (exploders) generate a shotgun-sounding blast. In general, birds quickly habituate to cannons that detonate at systematic or random intervals throughout the day. Thus, to be effective cannons should be moved periodically, used sparingly, and then only when birds are in the area. Reinforcement by occasional killing of a few birds (of common species such as gulls and starlings under an appropriate permit) with a shotgun may also enhance effectiveness. Systems designed so that cannons placed around an airport can be detonated remotely on demand by radio signal when birds are in the area are a useful feature to reduce habituation.

Distress-call and electronic noise-generating systems. Recorded distress calls are available for common birds at airports such as gulls, crows, and starlings. Such calls, broadcast from speakers mounted on a vehicle, will often initially draw the birds toward the sound source to investigate the threat. The birds then can be dispersed by shell crackers or other pyrotechnics or by using a shotgun to shoot an occasional bird. As with propane cannons, distress calls routinely broadcast from stationary speakers, with no associated follow-up stimuli that provide additional fear or stress, have little utility. Birds also habituate rapidly to other electronic sound systems that generate a variety of sounds from a stationary speaker.

Shell crackers and other pyrotechnics. There are a variety of projectiles that can be fired from breech-loaded shotguns or from specialized guns to provide an auditory blast or scream, as well as smoke and flashing light, to frighten birds. Some of the newer

cartridges have ranges of up to 300 yards. These pyrotechnics, when used skillfully in combination with other harassment techniques and limited lethal control (shooting via shotgun), can be very useful in driving birds off an airport. An advantage of these pyrotechnic devices is that they require a person to fire the projectile, thus ensuring that they are deployed directly at the target birds and that the birds associate the pyrotechnic with a threat (person).

Ultrasonic sound devices. Ultrasonic (i.e., above the sound range detected by humans) sound devices have not proven to be effective bird repellents. In fact, most birds do not detect frequencies as high as humans can detect, much less frequencies above the level of human detection. During tests conducted by the U.S. Department of Agriculture's National Wildlife Research Center, pigeons showed no response when exposed within 10 feet to a fully functional, high-frequency sound generating device. Such devices should not be deployed in hangars or other airport settings to deter birds.

9.2.c.v Audio Repellents for Mammals

Probably the most commonly used audio scaring device for deer is the propane cannon. However, deer rapidly habituate to propane cannons. Their use at airports to repel deer and other mammals from runways is not recommended except for very short-term (i.e., several days), emergency situations until a more permanent solution (fencing or deer removal) can be achieved. Other electronic noise-generating devices also have proven ineffective in repelling deer or other mammals for more than a few days. Pyrotechnics also provide only short-term repellency for mammals.

In one test conducted by USDA, large eye-flags were exposed to pigeons in an abandoned building. As soon as the flags were put up the birds left the building, but within 24 hours they returned. From then on the birds behaved in a normal fashion and showed no reaction to the flags. (Photo by R. A. Dolbeer, USDA)

9.2.c.vi Visual Repellents for Birds

Most visual repellents are simply a variation on an ancient theme -- the scarecrow. In general, visual repellents such as hawk effigies or silhouettes, eye-spot balloons, flags, and Mylar reflecting tapes have shown only short-term effectiveness and are inappropriate for use as a long-term solution to bird problems at airports. Most short-term success achieved with these devices is likely attributable to "new object reaction" rather than to any actual frightening effect produced by them.

There has been interest in recent years in the use of laser rifles (laser beams dispensed from a laser source attached to a rifle stock with a rifle scope as a "gun sight") to disperse birds at airports and other sites. The laser beam is aimed at

individual birds or flocks of birds. Effectiveness apparently is diminished in sunlit conditions. More experimental work is needed on this technique. The use of lasers in an airport environment obviously requires extreme caution.

9.2.c.vii Visual Repellents for Mammals

For the most part, visual repellents such as flags and effigies have proven ineffective for repelling mammals. Their use is not recommended for keeping deer or other mammals off airports.

9.2.c.viii Trained Falcons and Dogs to Repel Birds

Trained falcons and other birds of prey have been used intermittently on various airports in Europe and North America to disperse birds since the late 1940s. The advantage of falconry is that the birds on the airport are exposed to a natural predator for which they have an innate fear. The disadvantage is that a falconry program is often expensive, requiring a number of birds that must be maintained and cared for by a crew of trained, highly motivated personnel. Furthermore, the effectiveness of falconry programs in actually reducing strikes has been difficult to evaluate.

The successful use of border collies to repel birds requires a high degree of dedication and commitment by the handler. (Photo by B. U. Constantin, USDA)

Blokpoel (1976) outlined the following summary of falconry for airports that is still a good overall assessment : 1) properly trained birds of prey of the right species for the job at hand, used regularly and persistently by skilled and conscientious personnel, are effective in clearing birds from airfields during daylight and good weather; 2) for good results, daily operations on a year-round basis are required in most cases; 3) several falcons are required to have at least 1 bird ready at all times; and 4) to obtain, train, operate and care for falcons, a staff of at least 2 full-time, well-trained personnel is required.

The use of trained dogs, especially border collies, to chase geese and other birds from golf courses, airports and other sites, is a recent development. As with falcons, the advantage is exposure to a natural predator. Likewise, the disadvantage is that the dog must be under the control of a trained person at all times, and the dog must be

cared for and exercised 365 days a year. A dog will have little influence on birds that are flying over the airport.

9.2.c.ix Radio-controlled Model Aircraft to Repel Birds

Radio-controlled (RC) model aircraft, which provide both visual and auditory stimuli, occasionally have been used to harass birds at airports. One advantage is that the RC aircraft is under the control of a person and can be directed precisely to herd the birds away from the airport runway. A second advantage is that the RC aircraft can be deployed on an "as needed" basis with little maintenance needed between flights. Some RC aircraft have been designed to mimic the appearance of a falcon and even to remotely fire pyrotechnics. The disadvantage is that a trained person is required to operate the RC aircraft in an airport environment. Operators of RC aircraft should insure that the radio frequencies being used are compatible with other radio uses in the airport environment.

9.2.d Wildlife Removal Techniques

Habitat modification, exclusion, and repellent techniques are the first lines of action in any Wildlife Hazard Management Plan. However, these actions will not solve every problem; therefore, hazardous wildlife sometimes must be removed from an airport. Such removal can be accomplished by capturing and relocation or by killing the target animals. With few exceptions, a federal Migratory Bird Depredation Permit, and in many cases a state permit, is required before any migratory birds may be taken (captured or killed). A state permit is generally necessary before any state-protected birds or mammals may be taken. Any capturing or killing must be done humanely and only by people who are trained in wildlife species identification and the techniques to be deployed.

9.2.d.i Capturing Birds and Mammals

The disposition of live-captured birds and mammals will depend on the legal, political, and social realities of each situation. State wildlife agencies are increasingly restrictive regarding the relocation of captured wild animals, particularly for common species, because of disease concerns and the creation of additional wildlife problems at release sites. When practical, unprotected birds such as pigeons, house sparrows and European starlings, should be euthanized using procedures recommended by the American Association of Wildlife Veterinarians (AAWV). Common mammals such as raccoons, woodchucks, and coyotes captured at airports generally also should be euthanized, following state regulations. Resident Canada geese captured during molt or by nets can be euthanized and donated to soup kitchens or food banks, provided the necessary federal and state permits are in place.

9.2.d.i.a Chemical Capture of Birds

Alpha Chloralose (A-C) is registered with the FDA as an immobilizing agent for use in capturing waterfowl, coots, and pigeons. A-C can only be used by people certified to use A-C working under authority of personnel with the U.S. Department of Agriculture, Wildlife Services (USDA/WS). A-C, incorporated into bread baits, is ideal for selectively capturing ducks, geese and coots that can be hand-fed at urban ponds and parks. Corn baits are recommended for pigeons or groups of waterfowl or coots that cannot be individually baited. Birds ingesting a clinical dose of A-C can be captured in 30 to 90 minutes. Complete recovery normally occurs within 8 hours but can take up to 24 hours.

Alpha Chloralose (A-C) is ideal for capturing waterfowl that can be individually fed. Here, USDA personnel are using A-C treated bread baits to capture mute swans at a pond in Ohio, December 1994. (Photo by E. C. Cleary,

9.2.d.i.b Live-trapping Birds

The major advantage of live trapping is selectivity: any nontarget birds can be released unharmed. The major disadvantage is that live trapping is often labor intensive. Traps must be tended frequently to remove captured animals and, in the case of cage traps with decoy birds, to provide food and water. Hygnstrom et al. (1994) provide detailed descriptions of various trap designs.

Trapping is used on some airports to remove raptors (hawks and owls) in the aircraft operating area. Bal-chatri, noose carpets, Swedish goshawk, or sliding padded pole traps are typically used. Because raptors are desirable components of bird communities, most permits for trapping raptors require that the birds be banded and relocated into suitable habitat at least 50 miles from the airport.

Safety, for both the personnel involved and the wildlife, must be a prime consideration when using a rocket net to capture gulls or other birds. (Photo by P. P. Woronecki, USDA)

Live trapping, using walk-in type traps on roofs or other isolated sites, can be used to remove pigeons at airports. Captured pigeons should be euthanized. If relocated, pigeons can fly long distances to return to the site of capture.

Cannon or rocket nets are well suited for capturing up to 100 or more nuisance waterfowl, pigeons or gulls in situations where other methods may not be practical. The net must be placed where it can be safely discharged, and the target birds must be trained to feed in

front of it. Depending on the situation, prebaiting can take from 1 to several days.

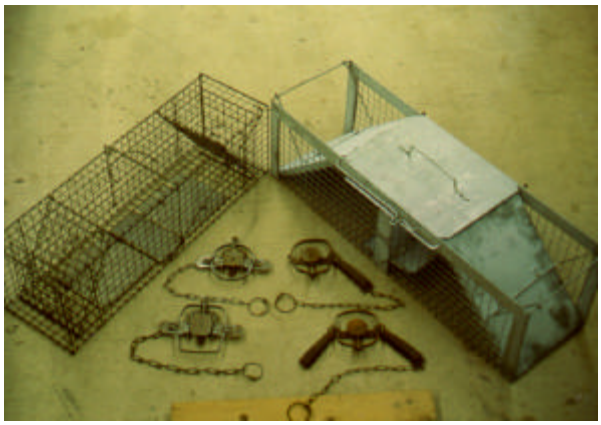
Net launchers use a single large rifle blank cartridge to propel a net. Fired from the shoulder much like a shotgun or rifle, net launchers can capture individual or small groups of problem birds that can be approached within about 50 feet.

9.2.d.i.c Chemical Capture of Mammals

Large mammals such as deer can be captured with tranquilizer guns, but this is generally not a practical or desirable option for airports. Live capture and relocation of deer is not recommended or permitted in most states because deer populations are at or near carrying capacity. However, in those situations where the use of firearms is not safe or practical, the use of tranquilizer guns may be appropriate. The use of tranquilizer guns requires trained personnel with a high degree of skill and experience. If used in an airport environment, safeguards must be in place to insure partially tranquilized deer do not enter runway areas.

9.2.d.i.d Live-trapping Mammals

Specialized drop-door traps, drop nets, or rocket net set-ups can be used to live-capture deer, but live-capturing deer generally is not recommended for airport situations for reasons outlined above. However, smaller box-type or basket live-traps can be used to capture medium-sized mammals such as raccoons, woodchucks, beavers and feral dogs. Leg-hold traps and foot snares can be used to capture coyotes, feral dogs and raccoons.



A variety of traps are available for use in capturing small to medium-sized mammals. Their successful use requires a high degree of skill, perseverance, and experience. (Photo by E. C. Cleary, FAA)

Successful mammal trapping, especially with leg-hold traps and snares, requires a high degree of skill and experience. Once set, traps must be checked frequently (at least once every 24 hours and more frequently in hot or cold weather). Trappers must be knowledgeable in procedures for handling and euthanizing mammals. State and local regulations may restrict the use of some types of traps.

9.2.d.ii Killing Birds and Mammals

In general, killing of wildlife on an airport is the last option deployed after habitat modification, exclusion techniques, and repellent actions have been implemented.

However, the management of a wildlife hazard situation on an airport may require killing a particular animal, or require that a local population of a problem species be reduced by lethal means until a long-term, nonlethal solution is implemented (e.g., erection of deer-proof fence, relocation of nearby gull nesting colony). In addition, lethal control of a few individuals is sometimes necessary to reinforce nonlethal frightening techniques. At least some lethal control is usually necessary as part of an integrated Wildlife Hazard Management Plan for an airport.

In order to justify lethal control and to minimize adverse public reaction to a program involving killing, the following information should be developed:

1. Documentation that the wildlife species is an economic, safety or health threat on the airport;

2. Justification of why nonlethal options are not adequate to solve the problem;

3. An assessment of the impact that the killing will have on local and regional populations of the species (i.e., is the level of killing planned likely to result in a significant reduction in numbers of the species at the local or regional level?);

4. Documentation of the effectiveness of the killing program in helping to solve the problem (e.g., reduction in strikes);

5. Recommended steps to be taken, if any are feasible, to reduce the need for killing in the future.

9.2.d.ii.a Destroying Eggs and Nests

Canada geese, mute swans and gulls should not be allowed to nest on airport property. Provided the correct permits are in place, any goose, mute swan or gull nests with eggs found on an airport should be destroyed (eggs broken and nest material removed). Egg addling (oiling, shaking or puncturing), whereby the birds continue to incubate nonviable eggs, is not recommended for airports. Egg addling encourages the nesting birds (and any nonbreeding birds associated with them) to stay on the airport. At the time of nest destruction, the adult birds should be harassed from the airport, and the nesting area should be checked weekly for renesting until the

Canada geese should not be allowed to nest on airport property. Nests and eggs should be destroyed after appropriate permits are obtained. (Photo by J. L. Bucknall, USDA)

end of the nesting season (generally the end of June). As an alternative to harassment, it may be better to shoot nesting geese and mute swans (see below).

Nests of pigeons, starlings, and house sparrows at airports should be destroyed whenever they are encountered in buildings and structures. Physical barriers, as discussed above, should then be installed where practical to prevent renesting.

Nests of other birds hazardous to aviation generally also should be destroyed when encountered at airports. However, each situation will have to be addressed on a case by case basis, depending on the species of bird and level of threat posed, location from runways, bird movement patterns and other factors.

9.2.d.ii.b Shooting Birds

The occasional use of a shotgun to kill gulls and other common birds, after permits have been obtained, is sometimes necessary to enhance other frightening methods, such as propane cannons. (Photo by R. A. Dolbeer, USDA)

Shooting birds in an airport environment generally falls into 2 categories. First, pigeons using hangars, bridge girders and other sites can be shot at night with an air rifle. This night-time shooting is done quietly and discretely, with the objective being to disturb the birds as little as possible so that the maximum number can be removed.

In the second category of shooting, common birds such as gulls and geese in the aircraft movement area that are not responding to various repellent methods can be shot with a 12-gauge shotgun. This shooting is done during daylight in the open so that other birds can witness the action. Shooting a shotgun has several effects on a flock of birds. First, shooting reinforces other audio or visual repelling techniques. Second, the loud noise, coupled with the death of one or more of the flock members, can frighten the rest of the flock away. Third, the target birds are removed.

Four cardinal rules apply when using shooting as a control method at airports:

1. Use only personnel who are trained in the use of firearms and who have an excellent knowledge of wildlife identification;

2. Use the proper gun and ammunition for the situation;

3. Have necessary federal and state wildlife kill permits in place and keep good records of birds killed by species and date;

4. Notify airport security, air traffic control and, if appropriate, the local law enforcement authority, before instituting a shooting program. Local ordinances against the discharge of firearms within certain distances of buildings, or within the city limits may have to be waived.

9.2.c.ii.c Shooting Mammals

There should be a "zero tolerance" for deer at airports. If fencing is inadequate to keep deer off an airport or if deer have gotten inside the airport fence, shooting is the best procedure for removing the deer. Shooting on airports should be done by professional sharpshooters, using non-ricocheting bullets in rifles equipped with night-vision scopes and noise suppressers, to ensure safe and efficient removal. Elevated shooting stands can be erected on the ground or on a truck bed to direct shots toward the ground. Meat from deer that are removed from airports in this manner should be donated to charity. Shooting of deer at airports must be coordinated through the state wildlife agency.

Hunting during the regular deer season should be encouraged in areas adjacent to airports having deer problems to reduce the population in the general area. Archery hunting sometimes can be used in areas closed to firearm use. (Photo by E. C. Cleary, FAA)

9.2.d.ii.d Oral Toxicants for Birds

Currently in the United States, only 1 oral toxicant, DRC-1339 or Starlicide (active ingredient 3-chloro-p-toluidine hydrochloride) is registered with the USEPA for use in bird population management. Starlicide (0.1% active ingredient) is formulated in a pelleted bait for use at feedlots to control starlings and blackbirds. DRC-1339 (98% active ingredient) can be formulated with a variety of baits and used to control starlings, pigeons, gulls, ravens and blackbirds under certain conditions, some of which may be applicable at airports. The control of pigeons around airport buildings and starlings roosting on or near an airport are the situations most likely applicable. Only USDA/WS personnel or persons working under their direct supervision can use DRC-1339.

The use of toxic baits to kill target birds without affecting nontarget species requires considerable skill and patience. Daily movement patterns of the target birds among feeding, loafing, and roosting sites must be determined so that attractive bait sites that are controlled from public access (such as a roof top) can be selected. The proper bait (a highly desired food) must be selected, and the birds then must be prebaited, often for a week or more, to ensure good bait acceptance and that nontarget animals are not visiting the bait site. Proper prebaiting is the most critical step of a successful program.

During the baiting period, all uneaten bait must be removed daily. With DRC-1339, birds typically die 1-3 days after bait ingestion; therefore, areas surrounding bait sites will need to be searched for several days after baiting to remove dead birds.

9.2.d.ii.e Contact Toxicants for Birds

Hollow metal perches, containing a wick treated with the toxicant, fenthion, have been used to control pigeons, house sparrows and starlings in and around buildings. Presently, the USEPA is phasing out the use of fenthion-treated perches because of concerns for secondary poisoning of raptors and mammalian scavengers feeding on dying birds. No replacement chemical has been registered at this time (1999).

If toxic perches become available, their use outside of buildings is not recommended because there are no means of preventing nontarget birds from landing on these perches. Even when used inside buildings, careful placement of perches and monitoring must be done to ensure nontarget birds such as swallows are not exposed to the toxicant. All dead birds should be picked up and properly disposed.

RESTRICTED USE PESTICIDE

For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicators certification.

ZINC PHOSPHIDE ON WHEAT

FOR MOUSE CONTROL

For the control of meadow voles, prairie voles, pine voles, mountain voles, and white-footed mice in ornamentals, orchards, vineyards, rangelands, forests, lawns, golf courses, parks, nurseries, and highway medians.

ACTIVE INGREDIENT:	
Zinc Phosphide	**1.82%**
INACTIVE INGREDIENTS:	**98.18%**
TOTAL	**100.00%**

This is the center portion of a zinc phosphide rodenticide label showing the restricted use statement, target species, and ingredients list. Other parts of the label that provide information about the product such as the manufacturer, EPA registration number, and the directions for use, are not shown here. Always read the entire label before using any pesticide.

9.2.c.ii.f Toxicants for Mammals

Small rodent populations (e.g., voles, house and deer mice, Norway rats) may erupt in grassy and brushy areas or around construction debris at airports, attracting raptors and creating a hazard to aviation. In general, populations of these rodents should be controlled by habitat management (mowing, sanitation, clean-up). However, there may be situations where the use of a rodenticide is appropriate to reduce rodent populations in airside vegetation. The control of commensal rodents in airport terminal buildings and other facilities will not be discussed here because these jobs are usually handled by private pest control operators.

There are 2 types of rodenticides that may be available for use in airside vegetation, anticoagulants and acute toxicants. Anticoagulants, of which there are several types registered, cause the rodent to die from internal bleeding. Some anticoagulants require multiple feedings to induce sufficient bleeding for death whereas others require only a single feeding. The only acute toxicant registered for above-ground treatment of field rodents is zinc phosphide,

available in pelleted and grain-bait formulations and as a concentrate for specialized bait formulations.

Depending on registration label instructions, rodenticide baits can be broadcast in the vegetation or hand-placed in burrows and runways. Anticoagulant baits can also be placed in various types of bait containers placed in areas of high rodent activity. Care must be taken to minimize nontarget bird and mammal exposure with broadcast and hand-placed baits.

9.2.c.ii.g Fumigants for Mammals

Several brands of gas cartridge are available to control burrowing rodents, such as woodchucks. (Photo by E. C. Cleary, FAA)

Burrowing rodents at airports, such as woodchucks (ground hogs) and prairie dogs, can be killed by fumigation of burrows with either gas cartridges or aluminum phosphide tablets. Gas cartridges, ignited from a burning fuse after placement in the burrow, generate carbon monoxide. Aluminum phosphide pellets react with moisture in the burrow to produce phosphine gas. Care must be taken to plug all burrow entrances with sod after placement of the cartridge or pellets in the burrow. Gas cartridges are a general use, over-the-counter pesticide. Aluminum phosphide pellets can only be applied by certified pesticide applicators and may not be available in all states. As with all pesticides, it is critical to make sure the wildlife species you are treating is covered under the registration for your state.

9.2.c.ii.h Lethal Traps for Mammals

Depending on state and local laws, Conibear^{R} (body gripping) traps can be used to remove woodchucks, beaver, and other medium-sized mammals that create problems at airports. Neck snares can be used to capture coyotes, beaver and certain other mammals. The use of these lethal traps requires a high degree of skill and experience. Once set, traps must be checked frequently (at least once every 24 hours and more frequently in hot or cold weather) to euthanize any animals that may be captured but not killed. Trappers must be knowledgeable in procedures for handling and euthanizing captured mammals.

9.3 CONCLUSIONS

Habitat modifications to minimize food, cover and water and physical barriers to exclude wildlife are the foundations of wildlife hazard management programs for airports. In addition, an integrated array of repellent techniques is necessary to disrupt

normal behavior and to stress hazardous wildlife that attempt to use the airport. These repellent techniques must be used judiciously and backed by real threats to minimize habituation. To this end, lethal control of selected individuals of common species is sometimes necessary to reinforce repellent actions. Furthermore, the management of a wildlife hazard situation on an airport may require removal of a particular animal or group of animals, or require that a local population of a problem species be reduced by lethal means until a long-term, nonlethal solution is implemented. Finally, the most critical factor for the success of a wildlife hazard management program is to have motivated and trained professionals who are knowledgeable about the wildlife species attempting to use the airport environment and the techniques used to manage the problems these species create.

Birds and aircraft will always share the skies, and there will always be the risk of collisions. To minimize that risk, airports must be managed to be as unattractive to birds as possible. Integrating various control strategies offers the maximum long-term effectiveness, immediate relief from a hazardous situation and minimizes the need for the use of lethal control methods. (Photo courtesy USDA)

9.4 OTHER SOURCES OF INFORMATION

For details on techniques, equipment, chemical registrations, species-specific management recommendations and sources of supply, the reader is referred to:

Hygnstrom, S. C., R. M. Timm, and G. E. Larson, *editors.* 1994. *Prevention and control of wildlife damage*. University of Nebraska Cooperative Extension Division, Lincoln, Nebraska. (This 2-volume manual is also available online at: ianrwww.unl.edu/wildlife/solutions/handbook/)

In addition, Appendix K provides a list of research publications by the U.S. Department of Agriculture, National Wildlife Research Center (NWRC) documenting results of evaluations of various wildlife control products and strategies. These evaluations were conducted between 1992-1999 with support from the FAA under an interagency agreement with NWRC. This is not a complete list of all evaluations that have been done on all wildlife control methods, but it does provide information on many of the control methods discussed in this chapter.

SELECTED PUBLICATIONS AND WEB SITES

In addition to these publications and web sites, a list of wildlife field guides and reference books is provided at the end of Chapter 7. Also, a list of publications on wildlife control techniques by the U.S. Department of Agriculture, National Wildlife Research Center, is provided in Appendix K.

Belant, J. L., S. K. Ickes, and T. W. Seamans. 1998. Importance of landfills to urban-nesting herring and ring-billed gulls. Landscape and Urban Planning 43:11-19.

Bellrose, F. C. 1980. Ducks, geese, and swans of North America, third edition. Stackpole Books, Harrisburg, PA. 540 pages.

Blokpoel, H. 1974. Bird hazards to aircraft. Canadian Wildlife Service. Ministry of Supply and Services, Ottawa, Ontario, Canada. 236 pages.

Blokpoel, H., and, G. D. Tessier. 1984. Overhead wires and monofilament lines exclude ring-billed gulls from public places. Wildlife Society Bulletin 12:55-53

Cleary, E. C., S. E. Wright and R. A. Dolbeer. 1999. Wildlife strikes to civil aircraft in the United States, 1990-1998. Federal Aviation Administration, Office of Airport Safety and Standards, Washington, DC. 29 pages.

Code of Federal Regulations:

National Archives and Records Administration. 1993. Code of Federal Regulations, Title 40, Part 253, Criteria for Municipal Solid Waste Landfills, section 253.10, Airport Safety. Washington, DC.

National Archives and Records Administration. 1994. Code of Federal Regulations, Title 50, Parts 1-199, Wildlife and Fisheries, Washington, DC. 615 pages.

National Archives and Records Administration. 1993. Code of Federal Regulations, Title 14, Part 139, Certification and Operation: Land Airports Serving CAB-Certificated Scheduled Air Carriers Operating Large Aircraft (Other Than Helicopters), Washington, DC. 93 pages.

Dolbeer, R. A., J. L. Belant, and J. L. Sillings. 1993. Shooting gulls reduces strikes with aircraft at John F. Kennedy International Airport. Wildlife Society Bulletin 21:442-450.

Dunning, J. B. Jr., editor. 1993. CRC Handbook of Avian Body Masses. CRC Press, Boca Raton, Florida. 371 pages. (Body weights for birds throughout the world)

Gill, F. B. 1990. Ornithology. W. H. Freeman and Company. New York. 660 pages.

Hygnstrom, S. C., R. M. Timm, and G. E. Larson, *editors.* 1994. *Prevention and control of wildlife damage*. University of Nebraska Cooperative Extension Division, Lincoln, NE. (This 2-volume manual is also available online at : ianrwww.unl.edu/wildlife/solutions/handbook/)

Knittle, C. E., and R. D. Porter, 1993. Waterfowl damage and control methods in ripening grain: an overview. U.S. Fish and Wildlife Service, Fish and Wildlife Technical Report 14, Washington, DC. 17 pages.

Linnel, M. A., M. R. Conover, and T. J. Ohashi. 1999. Biases in bird strike statistics based on pilot reports. Journal of Wildlife Management 63:997-1003.

Seubert, J. L. 1994. Assessing the implementation of wildlife hazard management programs at civil airports. Proceedings Bird Strike Committee Europe 22:275-284.

Smith, A. E., S. R. Craven, and P. D. Curtis. 1999. Managing Canada geese in urban environments. Jack Berryman Institute Publication 16, and Cornell Cooperative Extension, Ithaca, NY.

Transport Canada, Airports Group. 1994. Wildlife Control Procedures Manual. TP11500E. Ottawa, Ontario.

Wright, S. E., R. A. Dolbeer, and A. J. Montoney. 1993. Deer on airports: an accident waiting to happen. Vertebrate Pest Conference 13:90-95.

Web Sites:

Bird Strike Committee USA. **www.birdstrike.org/**

Prevention and control of wildlife damage (2-volume manual). University of Nebraska Cooperative Extension Division, Lincoln, NE.
ianrwww.unl.edu/wildlife/solutions/handbook/

Transport Canada, Airports Group. Wildlife Control Procedures Manual.
www.tc.gc.ca/aviation/wildlife

U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services. **www.aphis.gov.usda.gov/ws**

U.S. Department of Defense, U.S. Air Force Bird Aircraft Strike Hazard (BASH) Team. **www.afsc.saia.af/mil/AFSC/Bash**

U.S. Department of Interior, Fish and Wildlife Service. **www.fws.gov/**

U.S. Department of Transportation, Federal Aviation Administration, Airports Division. **www.faa.gov/arp/**

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GLOSSARY

Air carrier. A person who holds or who is required to hold an air carrier operating certificate issued under 14 CFR 139 while operating air carrier aircraft as defined in 14 CFR 139.

Air carrier aircraft. An aircraft with a specific seating capacity, defined in 14 CFR 139, which is being operated by an air carrier.

Air carrier operation. The takeoff or landing of an air carrier aircraft and includes the period of time from 15 minutes before and until 15 minutes after the takeoff or landing (14 CFR 139.3).

Airport. An area of land or other hard surface, excluding water, that is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any (14 CFR 139.3).

Airport operator. The operator (private or public) or sponsor of a public use airport.

Airport operating certificate. A certificate, issued under 14 CFR 139, for operation of an airport serving air carriers operations.

Approach or departure airspace. The airspace, within 5 statute miles of an airport, through which aircraft move during landing or takeoff.

Bird hazard. See **Wildlife hazard.**

Bird strike. See **Wildlife strike.**

Carrying capacity. The maximum number of animals of a given species which a habitat is capable of supporting on a sustained basis. The goal of wildlife management programs at airports is to eliminate or minimize the carrying capacity of habitat for species hazardous to aviation.

Certificate holder. The holder of an airport operating certificate or a limited airport operating certificate, except that as used in subpart D (of 14 CFR 139) "certificate holder" does not mean the holder of a limited airport operating certificate if its airport certification specifications, or this part, do not require compliance with the section in which it is used (14 CFR 139.3).

Concurrent use. Aeronautical property used for compatible non-aviation purposes while at the same time serving the primary purpose for which it was acquired; and the use is clearly beneficial to the airport.

Cover. Vegetation covering a ground surface and serving as shelter for wildlife that are roosting, resting, nesting, or feeding.

Cover types. A descriptive term characterizing vegetative composition and physical characteristics of a plant community.

Dump. The actively used and unvegetated part of an area where refuse is placed and allowed to accumulate on the ground surface without periodic covering or compacting. This includes both authorized and unauthorized areas.

Edge (ecotone). The border where 2 cover types meet. These transition zones usually provide more diverse vegetation and physical habitat characteristics, which may contribute to increased wildlife species diversity and numbers.

Fly ash. The fine, sand-like residue resulting from the complete incineration of an organic fuel source. Fly ash typically results from the combustion of coal or waste used to operate a power generating plant.

Hazardous wildlife. Species of wildlife (birds, mammals, reptiles), including feral animals and domesticated animals not under control, that are associated with aircraft strike problems, are capable of causing structural damage to airport facilities, or act as attractants to other wildlife that pose a strike hazard (Advisory Circular 150/5200-33 – *Hazardous Wildlife Attractants on or Near Airports*; 14 CFR 139.3)

Heliport. An airport or an area of an airport used or intended to be used for the landing and takeoff of helicopters (14 CFR 139.3).

Landfill. An area of land or an excavation in which wastes are placed for permanent disposal, and which is not a land application unit, surface impoundment, injection well, or waste pile. See also Municipal Solid Waste Landfill (40 CFR 257.2).

Mammal strike. See **Wildlife strike.**

Migratory Bird. "[A] migratory bird [is] … any bird whatever its origin and whether or not raised in captivity, which belongs to a species listed in Section 10.13 [of 50 CFR] or which is a mutation or a hybrid of any such species, including any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consist, or is composed in whole or part, of any such bird, or any part, nest, or egg there of." (50 CFR 10.12). This list includes almost all native bird species in the United States, with the exception of nonmigratory game birds such as pheasants, turkeys and grouse. Exotic and feral species such as mute swans, graylag geese, muscovy ducks, European starlings, house (English) sparrows, and rock doves (pigeons) also are not listed in 50 CFR 10.13 and are therefore not protected by federal law.

Migration. The periodic movement of a wildlife species from one geographic area to another, usually in correlation with seasonal changes in weather.

Municipal Solid Waste Landfill (MSWLF). A discrete area of land or an excavation that receives household waste, and that is not a land application unit, surface impoundment, injection well, or waste pile. A MSWLF unit also may receive other type of Resource Conservation Recovery Act Subtitle D industrial solid waste. Such a landfill may be publicly or privately owned. An MSWLF unit may be a new MSWLF unit, an existing MSWLF unit or a lateral expansion (40 CFR 257.2).

Movement area. The runways, taxiways, and other areas of an airport which are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and aircraft parking areas (14 CFR 139.3).

Pesticide. (1) Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, (2) any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant, and (3) any nitrogen stabilizer (7 U.S.C.A. 136[u]).

Piston-use airport. Any airport that would primarily serve fixed-wing, piston-powered aircraft. Incidental use of the airport by turbine-powered, fixed-wing aircraft would not affect this designation. However, such aircraft should not be based at the airport.

Public-use airport. Any publicly owned airport or a privately owned airport used or intended to be used for public purposes.

Putrescible waste. Rotting organic material.

Putrescible-waste disposal operation. Landfills, garbage dumps, underwater waste discharges, or similar facilities where activities include processing, burying, storing, or otherwise disposing of putrescible material, trash, and refuse.

Propane cannon/exploder. A hollow cylinder that produces a loud explosion to frighten wildlife by the ignition of a metered amount of propane at timed or random intervals.

Pyrotechnics. Various combustible projectiles launched from shotgun, pistol or other device that produce noise, light and smoke to frighten wildlife.

Runway protection zone (RPZ). An area off the runway end to enhance the protection of people and property on the ground (see AC 150/5300-13). The dimensions of this zone vary with the airport design, aircraft, type of operation, and visibility minimum.

Sewage sludge. The de-watered effluent resulting from secondary or tertiary treatment of municipal sewage and/or industrial wastes, including sewage sludge as referenced in USEPA's *Effluent Guidelines and Standards*, 40 CFR Part 401.

Shoulder. An area adjacent to the edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface, support for aircraft running off the pavement, enhanced drainage, and blast protection (see AC 150/5300-13).

Take (of wildlife). To pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect any wild animal (50 CFR 10.12).

Turbine-powered aircraft. Aircraft powered by turbine engines including turbojets and turboprops but excluding turbo-shaft, rotary-wing aircraft.

Turbine-use airport. Any airport that routinely serves fixed-wing, turbine-powered aircraft.

Wastewater treatment facility. Any devices or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes, including Publicly Owned Treatment Works (POTW), as defined by Section 212 of the Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-576) and the Water Quality Act of 1937 (P.L. 100-4). This definition includes any pretreatment involving the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW (40 CFR 403.3 [o], [p], [q]).

Wildlife. Any wild animal, including all wild mammals, birds, reptiles, amphibians, and fish … (50 CFR 10.3). As used in this manual, wildlife also includes feral animals and domestic animals while out of the control of their owners (14 CFR 139.3).

Wildlife attractants. Any human-made structure, land-use practice, or human-made or natural geographic feature which can attract or sustain hazardous wildlife within the landing or departure airspace, aircraft movement area, loading ramps, or aircraft parking areas of an airport. These attractants can include but are not limited to architectural features, landscaping, waste disposal sites, wastewater treatment facilities, agricultural or aquacultural activities, surface mining, or wetlands (AC 150/5200-33).

Wildlife hazard. A potential for a damaging aircraft collision with wildlife on or near an airport (14 CFR 139.3).

Wildlife strike. A wildlife strike is deemed to have occurred when:

1. A pilot reports striking 1 or more birds or other wildlife;
2. Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike;
3. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;
4. Bird or other wildlife remains, whether in whole or in part, are found within 200 feet of a runway centerline, unless another reason for the animal's death is identified;
5. The animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, aircraft left pavement area to avoid collision with animal) (Transport Canada, Airports Group, *Wildlife Control Procedures Manual*, Technical Publication 11500E, 1994).

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ACRONYMS

AAAE	American Association of Airport Executives
AAWV	American Association of Wildlife Veterinarians
AC	Advisory Circular
A-C	Alpha-Chloralose
ADC	Animal Damage Control (former name of USDA/WS)
AGL	Above Ground Level
AMA	Aircraft Movement Area
APHIS	Animal and Plant Health Inspection Service
AOA	Aircraft Operating Area
ATC	Air Traffic Control
BASH	Bird Aircraft Strike Hazard (USAF)
BSCC	Bird Strike Committee Canada
BSC-USA	Bird Strike Committee USA
C&D Landfills	Construction and Demolition Landfills
CFR	Code of Federal Regulations
COE	United States Army Corps of Engineers
DOD	United States Department of Defense
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOD	Foreign Object Debris, Foreign Object Damage
FSS	Flight Service Station
MBTA	Migratory Bird Treaty Act
MOU	Memorandum of Understanding
MSWLF	Municipal Solid Waste Landfill
NWRC	National Wildlife Research Center (USDA)
OFA	Object Free Area
OFZ	Obstacle Free Zone
RPZ	Runway Protection Zone

TSS	Threshold Siting Surface
USAF	United States Air Force
USDA/WS	United States Department of Agriculture, Wildlife Services
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WCP	Wildlife Control Personnel
WHWG	Wildlife Hazard Working Group
WS	Wildlife Services (USDA)

APPENDIX A

NAMES, ADDRESSES, PHONE NUMBERS:

USDA, WILDLIFE SERVICES,

FAA, OFFICE OF AIRPORT SAFETY AND CERTIFICATION

(Names and addresses as of 1 September 1999)

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USDA WILDLIFE SERVICES

HEADQUARTERS			
U.S. Department of Agriculture Animal and Plant Health Inspection Service Wildlife Services Room 1624 South Agriculture Building Washington, DC 20250-3402 (mail address: USDA/APHIS/WS STOP 3402 Washington, DC 20250-3402)			
	William H. Clay Acting Deputy Administrator		(202) 720-2054 FAX: (202) 690-0053
OPERATIONAL SUPPORT STAFF			
USDA/APHIS/WS Operational Support Staff 4700 River Road, Unit 87, Room 2D05 Riverdale, MD 20737-1234			
	Martin Mendoza, Jr. Director		(301) 734-7921 FAX: (301) 734-5157
EASTERN REGION			
USDA/APHIS/WS Eastern Regional Office 920 Main Campus Drive, Suite 200 Raleigh, NC 27606			
	Gary E. Larson Regional Director		(919) 716-5631 FAX: (919) 716-5659
ALABAMA	Frank Boyd State Director	Room 118, Ext. Hall Auburn University AL 36849-5656	(334) 844-5670 FAX: (334) 844-5321
ARKANSAS	Thurman W. Booth State Director	600 W. Capitol Ave., Room 55, Little Rock, AR 72201	(501) 324-5382 FAX: (501) 324-7135
CONN.	See Massachusetts		
DELAWARE	See Maryland		
DC	See Maryland		
FLORIDA	Bernice Constantin State Director	2820 E. University Ave. Gainesville, FL 32641	(352) 377-5556 FAX: (352) 377-5559
GEORGIA	Douglas Hall State Director	School of Forest Res. University of Georgia Athens, GA 30602-2152	(706) 546-2020 FAX: (706) 546-2004
ILLINOIS	Kirk Gustad State Director	2869 Via Verde Dr., Springfield, IL 62703-4325	(217) 241-6700 FAX: (217) 241-6702

INDIANA	Judy Loven State Director	Purdue University 1158 Smith Hall W. Lafayette, IN 47907-1158	(765) 494-6229 FAX: (765) 494-9475
IOWA	See Missouri		
KENTUCKY	See Tennessee		
LOUISIANA	Dwight LeBlanc State Director	P.O. Box 589 Port Allen, LA 70767-0589	(225) 389-0229 FAX: (225) 389-0228
MAINE	Edwin Butler State Director	81 Leighton Rd, Suite 12 Augusta, ME 04330	(207) 622-8263 FAX: (207) 622-5760
MARYLAND/ DEL./DC	Les Terry State Director	2530 Riva Rd, Suite 312 Annapolis, MD 21401	(410) 269-0057 FAX: (410) 269-0258
MASS./ RHODE IS./ CONN.	Laura Henze State Director	463 West Street Amherst, MA 01002	(413) 253-2403 FAX: (413) 253-7577
MICHIGAN	H. Peter Butchko State Director	2803 Jolly Rd, Ste.160 Okemos, MI 48864	(517) 336-1928 FAX: (517) 336-1934
MINNESOTA	See Missouri		
MISSISSIPPI	Kris C. Godwin State Director	P.O. Drawer FW Mississippi State, MS 39762	(601) 325-3014 FAX: (601) 325-3690
MISSOURI/ IOWA/MINN.	Ed Hartin State Director	2407 Industrial Dr. Columbia, MO 65202-1280	(573) 446-1862 FAX: (573) 446-1942
N HAMPSHIRE/ VERMONT	Dennis Slate State Director	59 Chenell Dr., Suite 7 Concord, NH 03301-S548	(603) 223-6832 FAX: (603) 229-1951
NEW JERSEY/ PENN.	Janet Bucknall State Director	140-C Locust Grove Rd., Pittstown, NJ 08867-9529	(908) 735-5654 (908) 735-4513 FAX: (908) 735-0821
NEW YORK	Richard Chipman State Director	1930 Route 9 Castleton, NY 12033-9653	(518) 477-4837 FAX: (518) 477-4899
N. CAROLINA	Jon Heisterberg State Director	6213-E Angus Dr. Raleigh, NC 27613	(919) 856-4124 FAX: (919) 782-4159
OHIO	Andy Montoney State Director	Fed. Bldg., Rm 622 200 N. High St. Columbus, OH 43215	(614) 469-5681 FAX: (614) 469-2912
PENN.	See New Jersey		
RHODE IS.	See Massachusetts		
S. CAROLINA	Robert Hudson State Director	400 Northeast Dr., Suite L Columbia, SC 29203-5182	(803) 786-9455 FAX: (803) 786-9472

TENNESSEE/ KENTUCKY	Kenneth Garner State Director	441 Donelson Pike, Suite 340 Nashville, TN 37214	(615) 736-5506 FAX: (615) 736-2768
VERMONT	See New Hampshire		
VIRGINIA	Martin Lowney State Director	P.O. Box 130 21425 Hull St. Rd. Moseley, VA 23120	(804) 739-7739 FAX: (804) 739-7738
VIRGIN ISLANDS.	See Alabama		
W. VIRGINIA	William Bonwell State Director	730 Yokam Street Elkins, WV 26241	(304) 636-1785 FAX: (304) 636-5397
WISCONSIN	John Maestrelli State Director	750 Windsor Street Sun Prairie, WI 53590	(608) 837-2727 FAX: (608) 837-6754
WESTERN REGION			
USDA/APHIS/WS Western Regional Office 12345 West Alameda Parkway, Suite 204 Lakewood, CO 80228			
	Michael Worthen Regional Director		(303) 969-6565 x 222 FAX: (303) 969-6578
ALASKA	See Washington		
ARIZONA	Steve Fairaizl State Director	2224 W. Desert Cove Ave. Suite 209 Phoenix, AZ 85029	(602) S70-2081 FAX: (602) 870-2951
CALIFORNIA	Gary Simmons State Director	P.O. Box 255348 Sacramento, CA 95865-5348	(916) 979-2675 FAX: (916) 979-2680
COLORADO	Craig C. Coolahan State Director	12345 W. Alameda Pkwy Suite 210 Lakewood, CO 80228	(303) 969-5775 FAX: (303) 969-5798
HAWAII	See Washington		
IDAHO	Mark Collinge State Director	9134 W. Blackeagle Dr., Boise, ID 83709	(208) 378-5077 FAX: (208) 378-5349
KANSAS	See Nebraska		
MONTANA	Larry L. Handegard State Director	P.O. Box 1938 Billings, MT 59103	(406) 657-6464 FAX: (406) 657-6110
NEBRASKA/ KANSAS	Jim Luchsinger State Director	5940 S. 58th St., P.O. Box 81866 Lincoln, NE 68501	(402) 434-2340 FAX: (402) 434-2330
NEVADA	Robert Beach State Director	4600 Kietzke Lane, Building 0 Reno, NV 89502	(702) 784-5081 FAX: (702) 784-5874
NEW MEXICO	Alex Lara State Director	2113 Osuna Rd., NE Suite B Albuquerque, NM 87113	(505) 346-2640 FAX: (505) 346-2627

NORTH/SOUTH DAKOTA	Phil Mastrangelo State Director	2110 Miriam Circle Suite A Bismarck, ND 58501	(701) 250-4405 FAX: (701) 250-4408
OKLAHOMA	John Steuber State Director	P.O. Box 528804 Oklahoma City, OK 73152-9937	(405) 521-4039 (405) 521-4040 FAX: (405) 525-5951
OREGON	David Williams State Director	6135 NE 80th, Suite A8 Portland, OR 97218	(503) 326-2346 FAX: (503) 326-2367
TEXAS	Gary L. Nunley State Director	P.O. Box 100410 San Antonio, TX 78201-1710	(210) 472-5451 FAX: (210) 472-5446
UTAH	Mike Bodenchuck State Director	P.O. Box 26976 Salt Lake City, UT 84126	(801) 975-3315 FAX: (801) 975-3320
WASHINGTON/ HAWAII/ ALASKA/ PACIFIC ISLANDS.	J. Gary Oldenburg State Director	720 O'Leary Street, NW. Olympia, WA 98502	(360) 753-9884 FAX: (360) 753-9466
WYOMING	Richard Phillips State Director	6731 W. Coal Rd Casper, WY 82604	(307) 261-5336 FAX: (307) 261-5996
NATIONAL WILDLIFE RESEARCH CENTER			
USDA/APHIS/WS/NWRC 4101 LaPorte Avenue Ft. Collins, CO 80521-2154			
	Richard Curnow Director		(970) 266-6036 FAX: (970) 266-6032

FEDERAL AVIATION ADMINISTRATION		
FAA National Headquarters Airports Division 800 Independence Avenue, SW Washington, DC 20591		
Name	Mail Stop	Phone Number
Bob David, Division Manager	AAS-300	(202) 267-3085
Ben Castellano, Branch Manager	AAS-310	(202) 267-8728
Linda Bruce (AGL)	AAS-311B	(202) 267-8553
Ed Cleary (Wildlife Management)	AAS-317	(202) 267-3389
Ed Dorsett (ANE, ASO)	AAS-311D	(202) 267-8792
Ken Gillian (Fire Safety Specialist)	AAS-310 Orlando	(407) 812-6331 x 34 Fax: (407) 812-6978
Kevin Hehir	AAS-318	(202) 267-8224
Dave Kurner (ANM)	AAS-311K	(202) 267-8729
Elizabeth Matarese (ASW, AWP, AAL)	AAS-311M	(202) 267-8723
Jose Roman (AEA, ACE)	AAS-310	(202) 267-8732
		Fax: (202) 267-5383
FAA Alaska Region Headquarters Airports Division 222 West 7th Avenue, #14 Anchorage, AK 99513		
Ron Simpson, Division Manager	AAL-600	(907) 271-5438
David Stelling, Branch Manager	AAL-620	(907) 271-5453
Dave Wahto	AAL-620	(907) 271-3815
Mack Humphrey	AAL-620	(907) 271-5444
Steve Powell	AAL-603	(907) 271-5448
Laurie Suttmeier	AAL-621C	(907) 271-3665
		Fax: (907) 271-2851

FAA Central Region Headquarters Airports Division 601 East 12th Street Federal Building Kansas City, MO 64106 Serving: KS, IA, MO, NE		
George Hendon, Division Manager	ACE-600	(816) 426-4698
Jim Brunskill, Branch Manager	ACE-620	(816) 426-4712
Glenn Helm	ACE-625	(816) 426-4722
Mike Mullen, Lead Inspector	ACE-625B	(816) 426-4721
Lyle Barber	ACE-626C	(816) 426-4724
Pat Shalda	ACE-625D	(816) 426-4723
		Fax: (816) 426-3265
FAA Eastern Region Headquarters Airports Division JFK International Airport Fitzgerald Building Jamaica, NY 11430 Serving: DE, MD, NJ, NY, PA, VA, WV		
Robert Mendez, Division Manager	AEA-600	(718) 553-3330
Harvey DeGraw, Branch Manager	AEA-620	(718) 553-3352
Vincent Cimino, Lead Inspector	AEA-620	(718) 553-3348
Dennis O'Donnell	AEA-620	(718) 553-3343
Ralph Carrozza	AEA-620	(718) 553-3342
Guillermo Felix	AEA-620	(718) 553-3345
Evelyn Martinez	AEA-620	(718) 553-3347
		Fax: (718) 995-5615

FAA Great Lakes Region Headquarters Airports Division O'Hare Lake Office Center 2300 East Devon Avenue Des Plaines, IL 60018 Serving: IL, IN, MI, MN, OH, ND, SD, WI		
Jeri Alles, Division Manager	AGL-600	(847) 294-7272
Henry Lamberts, Branch Manager	AGL-620	(847) 294-7387
John Lott, Lead Inspector	AGL-621.1	(847) 294-7533
Tricia Halpin	AGL-621.4	(847) 294-7160
Winsome Lenfert	AGL-621.5	(847) 294-7531
Birkely Rhodes	AGL-621.3	(847) 294-7247
Barb Dettmer	AGL-621.2	(847) 294-7354
		Fax: (847) 294-5615
FAA New England Regional Headquarters Airports Division 12 New England Executive Park Burlington, MA 01803 Serving: CT, MA, ME, NH, RI, VT		
Vince Scarano, Division Manager	ANE-600	(781) 238-7600
Brad Davis, Branch Manager	ANE-620	(781) 238-7620
Keith Barnett, Lead Inspector	ANE-620	(781) 238-7630
Laurie Hyman	ANE-620	(781) 238-7632
		Fax: (781) 238-7608

FAA Northwest Mountain Region Headquarters Airports Division 1601 Lind Avenue, SW Renton, WA 98055 Serving: CO, ID, MT, OR, UT, WA, WY		
Lowell Johnson, Division Manager	ANM-600	(425) 227-2600
Matt Cavanaugh, Branch Manager	ANM-620	(425) 227-2620
Harold Handke, Lead Inspector	ANM-627	(425) 227-2607

Mark Taylor	ANM-625	(425) 227-2625
Jack Hutchison	ANM-626	(425) 227-2626
Lynn Deardorff	ANM-621	(425) 227-1621
Jerry Trujillo	SEA-643	(425) 227-0629
		Fax: (425) 227-1600
FAA Southern Region Headquarters Airports Division 1701 Columbus Avenue College Park, GA 30337 (Mail Address: P. O. Box 20636, Atlanta, GA 30320) Serving: AL, FL, GA KY, MS, NC, PR, SC, TN, VI		
Steve Brill, Division Manager	ASO-600	(404) 305-6700
Anna Cohen, Lead Inspector	ASO-620.D	(404) 305-6714
Trish Chasse	ASO-620.K	(404) 305-6716
Linda Berkowitz	ASO-620.L	(404) 305-6715
Jack McSwain	AS0-620.J	(404) 305-6718
		Fax: (404) 305-6730

FAA Southwest Region Headquarters Airports Division 2601 Meacham Blvd. Fort Worth, TX 76137-4298 Serving: AR, LA, NM, OK, TX		
Naomi Saunders, Division Manager	ASW-600	(817) 222-5600
Joe Washington, Branch Manager	ASW-620	(817) 222-5620
Bruce Kirkendoll, Lead Inspector	ASW-621	(817) 222-5619
Bill Mitchell	ASW-621B	(817) 222-5625
Julie Netherton	ASW-621A	(817) 222-5624
Ron Hess	ASW-622	(817) 222-5622
Bob Hutchins	ASW-623	(817) 222-5623
		Fax: (817) 222-5986

FAA Western Pacific Region Headquarters Airports Division 15000 Aviation Boulevard Hawthorne, CA 90261 Courier address: use above address Mail address: P. O. Box 92007, World Postal Ctr, Los Angeles, CA 90009 Serving: AZ, CA, HA, NV		
Herman Bliss, Division Manager	AWP-600	(310) 725-3600
Ellsworth Chan, Branch Manager	AWP-620	(310) 725-3620
Bill Critchfield, Lead Inspector	AWP-622	(310) 725-3622
Elizabeth Louie	AWP-622.1	(310) 725-3636
William Long	AWP-622.2	(310) 725-3635
		Fax: (310) 536-8601

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APPENDIX B

ANIMAL DAMAGE CONTROL ACT,

2 MARCH 1931, AS AMENDED

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ANIMAL DAMAGE CONTROL ACT

7 U.S.C. §§ 426-426c, 2 March 1931, as amended 1937 and 1991.

Overview. This Act gives the Secretary of Agriculture broad authority to investigate and control certain predatory or wild animals and nuisance mammal and bird species.

Animal Damage Control. The Secretary is authorized to conduct investigations, experiments, and tests to determine the best methods of eradication, suppression, or bringing under control mountain lions, wolves, coyotes, bobcats, prairie dogs, gophers, ground squirrels, jack rabbits, brown tree snakes, and other animals injurious to agriculture, horticulture, forestry, animal husbandry, wild game animals, fur-bearing animals and birds. Another purpose of these investigations is to protect stock and other domestic animals through the suppression of rabies and tularemia in predatory or other wild animals. The Secretary is also directed to conduct campaigns for the destruction or control of these animals. In carrying out the Act, the Secretary may cooperate with states, individuals, agencies and organizations. § 426.

The Secretary is also authorized, except for urban rodent control, to control nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases. Agreements may be entered into with states, local jurisdictions, individuals, and organizations for this purpose. § 426c.

Brown Tree Snakes. Section 1013 of Public Law 102-237, which amended the Act in 1991, also requires the Secretary to initiate a program to prevent the inadvertent introduction of the brown tree snake into Hawaii from Guam. The Secretary also is required, to the extent practicable, to take action to prevent the inadvertent introduction of the brown tree snake into other areas of the U.S. from Guam. Public Law 102-190 requires the Secretary of Defense to take action to prevent its introduction by Department of Defense aircraft or vessels. §426 note.

Appropriations Authorized. Congress authorized the Secretary to make expenditures for equipment, supplies, and materials, including the employment of persons to carry out this Act. § 426b.

Historical Note. Public Law 99-190, approved in 1935, transferred administration of the Act from the Secretary of the Interior to the Secretary of Agriculture.

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APPENDIX C

FAA ADVISORY CIRCULAR 150/5200-33

HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS

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U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS

Date: 5/1/97
Initiated by: AAS-310 and APP-600

AC No: 150/5200-33
Change:

1. PURPOSE. This advisory circular (AC) provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports. It also provides guidance concerning the placement of new airport development projects (including airport construction, expansion, and renovation) pertaining to aircraft movement in the vicinity of hazardous wildlife attractants. Appendix 1 provides definitions of terms used in this AC.

2. APPLICATION. The standards, practices, and suggestions contained in this AC are recommended by the Federal Aviation Administration (FAA) for use by the operators and sponsors of all public-use airports. In addition, the standards, practices, and suggestions contained in this AC are recommended by the FAA as guidance for land use planners, operators, and developers of projects, facilities, and activities on or near airports.

3. BACKGROUND. Populations of many species of wildlife have increased markedly in the last few years. Some of these species are able to adapt to human-made environments, such as exist on and around airports. The increase in wildlife populations, the use of larger turbine engines, the increased use of twin-engine aircraft, and the increase in air-traffic, all combine to increase the risk, frequency, and potential severity of wildlife-aircraft collisions.

Most public-use airports have large tracts of open, unimproved land that are desirable for added margins of safety and noise mitigation. These areas can present potential hazards to aviation because they often attract hazardous wildlife. During the past century, wildlife-aircraft strikes have resulted in the loss of hundreds of lives world-wide, as well as billions of dollars worth of aircraft damage. Hazardous wildlife attractants near airports could jeopardize future airport expansion because of safety considerations.

DAVID L. BENNETT
Director, Office of Airport Safety and Standards

SECTION 1. HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS.

1-1. TYPES OF HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS. Human-made or natural areas, such as poorly-drained areas, retention ponds, roosting habitats on buildings, landscaping, putrescible-waste disposal operations, wastewater treatment plants, agricultural or aquacultural activities, surface mining, or wetlands, may be used by wildlife for escape, feeding, loafing, or reproduction. Wildlife use of areas within an airport's approach or departure airspace, aircraft movement areas, loading ramps, or aircraft parking areas may cause conditions hazardous to aircraft safety.

All species of wildlife can pose a threat to aircraft safety. However, some species are more commonly involved in aircraft strikes than others. Table 1 lists the wildlife groups commonly reported as being involved in damaging strikes to U.S. aircraft from 1993 to 1995.

Table 1. Wildlife Groups Involved in Damaging Strikes to Civilian Aircraft, USA, 1993-1995.

Wildlife Groups	Percent involvement in reported damaging strikes
Gulls	23
Waterfowl	23
Raptors	11
Doves	6
Vultures	5
Blackbirds-Starlings	5
Corvids	3
Wading birds	3
Deer	11
Canids	1

1-2. LAND USE PRACTICES. Land use practices that attract or sustain hazardous wildlife populations on or near airports can significantly increase the potential for wildlife-aircraft collisions. FAA recommends against land use practices, within the siting criteria stated in 1-3, that attract or sustain populations of hazardous wildlife
within the vicinity of airports or cause movement of hazardous wildlife onto, into, or across the approach or departure airspace, aircraft movement area, loading ramps, or aircraft parking area of airports.

Airport operators, sponsors, planners, and land use developers should consider whether proposed land uses, including new airport development projects, would increase the wildlife hazard. Caution should be exercised to ensure that land use practices on or near airports do not enhance the attractiveness of the area to hazardous wildlife.

1-3. SITING CRITERIA. FAA recommends separations when siting any of the wildlife attractants mentioned in Section 2 or when planning new airport development projects to accommodate aircraft movement. The distance between an airport's aircraft movement areas, loading ramps, or aircraft parking areas and the wildlife attractant should be as follows:

a. Airports serving piston-powered aircraft. A distance of 5,000 feet is recommended.

b. Airports serving turbine-powered aircraft. A distance of 10,000 feet is recommended.

c. Approach or Departure airspace. A distance of 5 statute miles is recommended, if the wildlife attractant may cause hazardous wildlife movement into or across the approach or departure airspace.

SECTION 2. LAND USES THAT ARE INCOMPATIBLE WITH SAFE AIRPORT OPERATIONS.

2-1. GENERAL. The wildlife species and the size of the populations attracted to the airport environment are highly variable and may depend on several factors, including land-use practices on or near the airport. It is important to identify those land use practices in the airport area that attract hazardous wildlife. This section discusses land use practices known to threaten aviation safety.

2-2. PUTRESCIBLE-WASTE DISPOSAL OPERATIONS. Putrescible-waste disposal operations are known to attract large numbers of wildlife that are hazardous to aircraft. Because of this, these operations, when located within the separations identified in the sitting criteria in 1-3 are considered incompatible with safe airport operations.

FAA recommends against locating putrescible-waste disposal operations inside the separations identified in the siting criteria mentioned above. FAA also recommends against new airport development projects that would increase the number of aircraft operations or that would accommodate larger or faster aircraft, near putrescible-waste disposal operations located within the separations identified in the siting criteria in 1-3.

2-3. WASTEWATER TREATMENT FACILITIES. Wastewater treatment facilities and associated settling ponds often attract large numbers of wildlife that can pose a threat to aircraft safety when they are located on or near an airport.

a. New wastewater treatment facilities. FAA recommends against the construction of new wastewater treatment facilities or associated settling ponds within the separations identified in the siting criteria in 1-3. During the siting analysis for wastewater treatment facilities, the potential to attract hazardous wildlife should be considered if an airport is in the vicinity of a proposed site. Airport operators should voice their opposition to such sitings. In addition, they should consider the existence of wastewater treatment facilities when evaluating proposed sites for new airport development projects and avoid such sites when practicable.

b. Existing wastewater treatment facilities. FAA recommends correcting any wildlife hazards arising from existing wastewater treatment facilities located on or near airports without delay, using appropriate wildlife hazard mitigation techniques. Accordingly, measures to minimize hazardous wildlife attraction should be developed in consultation with a wildlife damage management biologist. FAA recommends that wastewater treatment facility operators incorporate appropriate wildlife hazard mitigation techniques into their operating practices. Airport operators also should encourage those operators to incorporate these mitigation techniques in their operating practices.

c. Artificial marshes. Waste-water treatment facilities may create artificial marshes and use submergent and emergent aquatic vegetation as natural filters. These artificial marshes may be used by some species of flocking birds, such as blackbirds and waterfowl, for breeding or roosting activities. FAA recommends against establishing artificial marshes within the separations identified in the siting criteria stated in 1-3.

d. Wastewater discharge and sludge disposal. FAA recommends against the discharge of wastewater or sludge on airport property. Regular spraying of wastewater or sludge disposal on unpaved areas may improve soil moisture and quality. The resultant turf growth requires more frequent mowing, which in turn may mutilate or flush insects or small animals and produce straw. The maimed or flushed organisms and the straw can attract hazardous wildlife and jeopardize aviation safety. In addition, the improved turf may attract grazing wildlife such as deer and geese.

Problems may also occur when discharges saturate unpaved airport areas. The resultant soft, muddy conditions can severely restrict or prevent emergency vehicles from reaching accident sites in a timely manner.

e. Underwater waste discharges. The underwater discharge of any food waste, e.g., fish processing offal, that could attract

scavenging wildlife is not recommended within the separations identified in the siting criteria in 1-3.

2-4. WETLANDS.

a. Wetlands on or near Airports.

(1) Existing Airports. Normally, wetlands are attractive to many wildlife species. Airport operators with wetlands located on or nearby airport property should be alert to any wildlife use or habitat changes in these areas that could affect safe aircraft operations.

(2) Airport Development. When practicable, the FAA recommends siting new airports using the separations identified in the siting criteria in 1-3. Where alternative sites are not practicable or when expanding existing airports in or near wetlands, the wildlife hazards should be evaluated and minimized through a wildlife management plan prepared by a wildlife damage management biologist, in consultation with the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (COE).

NOTE: If questions exist as to whether or not an area would qualify as a wetland, contact the U.S. Army COE, the Natural Resource Conservation Service, or a wetland consultant certified to delineate wetlands.

b. Wetland mitigation. Mitigation may be necessary when unavoidable wetland disturbances result from new airport development projects. Wetland mitigation should be designed so it does not create a wildlife hazard.

(1) FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in the siting criteria in 1-3. Wetland mitigation banks meeting these siting criteria offer an ecologically sound approach to mitigation in these situations.

(2) Exceptions to locating mitigation activities outside the separations identified in the siting criteria in 1-3 may be considered if the affected wetlands provide unique ecological functions, such as critical habitat for threatened or endangered species or ground water recharge. Such mitigation must be compatible with safe airport operations. Enhancing such mitigation areas to attract hazardous wildlife should be avoided. On-site mitigation plans may be reviewed by the FAA to determine compatibility with safe airport operations.

(3) Wetland mitigation projects that are needed to protect unique wetland functions (see 2-4.b.(2)), and that must be located in the siting criteria in 1-3 should be identified and evaluated by a wildlife damage management biologist before implementing the mitigation. A wildlife damage management plan should be developed to reduce the wildlife hazards.

NOTE: AC 150/5000-3, *Address List for Regional Airports Division and Airports District/Field_Offices*, provides information on the location of these offices.

2-5. DREDGE SPOIL CONTAINMENT AREAS. FAA recommends against locating dredge spoil containment areas within the separations identified in the siting criteria in 1-3, if the spoil contains material that would attract hazardous wildlife.

SECTION 3. LAND USES THAT MAY BE COMPATIBLE WITH SAFE AIRPORT OPERATIONS.

3-1. GENERAL. Even though they may, under certain circumstances, attract hazardous wildlife, the land use practices discussed in this section have flexibility regarding their location or operation and may even be under the airport operator's or sponsor's control. In general, the FAA does not consider the activities discussed below as hazardous to aviation if there is no apparent attraction to hazardous wildlife, or wildlife hazard mitigation techniques are implemented to deal effectively with any wildlife hazard that may arise.

3-2. ENCLOSED WASTE FACILITIES. Enclosed trash transfer stations or enclosed waste handling facilities that receive garbage indoors; process it via compaction, incineration, or similar manner; and remove all residue by enclosed vehicles, generally would be compatible, from a wildlife perspective, with safe airport operations, provided they are not located on airport property or within the runway protection zone (RPZ). No putrescible-waste should be handled or stored outside at any time, for any reason, or in a partially enclosed structure accessible to hazardous wildlife.

Partially enclosed operations that accept putrescible-waste are considered to be incompatible with safe airport operations. FAA recommends these operations occur outside the separations identified in the siting criteria in 1-3.

3-3. RECYCLING CENTERS. Recycling centers that accept previously sorted, non-food items such as glass, newspaper, cardboard, or aluminum are, in most cases, not attractive to hazardous wildlife.

3-4. COMPOSTING OPERATIONS ON AIRPORTS. FAA recommends against locating composting operations on airports. However, when they are located on an airport, composting operations should not be located closer than the greater of the following distances: 1,200 feet from any aircraft movement area, loading ramp, or aircraft parking space; or the distance called for by airport design requirements. This spacing is intended to prevent material, personnel, or equipment from penetrating any Obstacle Free Area (OFA), Obstacle Free Zone (OFZ), Threshold Siting Surface (TSS), or Clearway (see AC 150/5300-13, *Airport Design*). On-airport disposal of compost by-products is not recommended for the reasons stated in 2-3.d.

a. Composition of material handled. Components of the compost should never include any municipal solid waste. Non-food waste such as leaves, lawn clippings, branches, and twigs generally are not considered a wildlife attractant. Sewage sludge, wood-chips, and similar material are not municipal solid wastes and may be used as compost bulking agents.

b. Monitoring on-airport composting operations. If composting operations are to be located on airport property, FAA recommends that the airport operator monitor composting operations to ensure that steam or thermal rise does not affect air traffic in any way. Discarded leaf disposal bags or other debris must not be allowed to blow onto any active airport area. Also, the airport operator should reserve the right to stop any operation that creates unsafe, undesirable, or incompatible conditions at the airport.

3-5. ASH DISPOSAL. Fly ash from resource recovery facilities that are fired by municipal solid waste, coal, or wood, is generally considered not to be a wildlife attractant because it contains no putrescible matter. FAA generally does not consider landfills accepting only fly ash to be wildlife attractants, if those landfills: are maintained in an orderly manner; admit no putrescible-waste of any kind; and are not co-located with other disposal operations.

Since varying degrees of waste consumption are associated with general incineration, FAA classifies the ash from general incinerators as a regular waste disposal by-product and, therefore, a hazardous wildlife attractant.

3-6. CONSTRUCTION AND DEMOLITION (C&D) DEBRIS LANDFILLS. C&D debris (Class IV) landfills have visual and operational characteristics similar to putrescible-waste disposal sites. When co-located with putrescible-waste disposal operations, the probability of hazardous wildlife attraction to C&D landfills increases because of the similarities between these disposal activities.

FAA generally does not consider C&D landfills to be hazardous wildlife attractants, if those landfills: are maintained in an orderly manner; admit no putrescible-waste of any kind; and are not co-located with other disposal operations.

3-7. WATER DETENTION OR RETENTION PONDS. The movement of storm water away from runways, taxiways, and aprons is a normal function on most airports and is necessary for safe aircraft operations. Detention ponds hold storm water for short periods, while retention ponds hold water indefinitely. Both types of ponds control runoff, protect water quality, and can attract hazardous wildlife. Retention ponds are more attractive to hazardous wildlife than detention ponds because they provide a more reliable water source.

To facilitate hazardous wildlife control, FAA recommends using steep-sided, narrow, linearly-shaped, rip-rap lined, water detention basins rather than retention basins. When possible, these ponds should be placed away from aircraft movement areas to minimize aircraft-wildlife interactions. All vegetation in or around detention or retention basins that provide food or cover for hazardous wildlife should be eliminated.

If soil conditions and other requirements allow, FAA encourages the use of underground storm water infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife.

3-3. LANDSCAPING. Wildlife attraction to landscaping may vary by geographic location. FAA recommends that airport operators approach landscaping with caution and confine it to airport areas not associated with aircraft movements. All landscaping plans should be reviewed by a wildlife damage management biologist. Landscaped areas should be monitored on a continuing basis for the presence of hazardous wildlife. If hazardous wildlife is detected, corrective actions should be implemented immediately.

3-9. GOLF COURSES. Golf courses may be beneficial to airports because they provide open space that can be used for noise mitigation or by aircraft during an emergency. On-airport golf courses may also be a concurrent use that provides income to the airport.

Because of operational and monetary benefits, golf courses are often deemed compatible land uses on or near airports. However, waterfowl (especially Canada geese) and some species of gulls are attracted to the large, grassy areas and open water found on most golf courses. Because waterfowl and gulls occur throughout the U.S., FAA recommends that airport operators exercise caution and consult with a wildlife damage management biologist when considering proposals for golf course construction or expansion on or near airports. Golf courses should be monitored on a continuing basis for the presence of hazardous wildlife. If hazardous wildlife is detected, corrective actions should be implemented immediately.

3-10. AGRICULTURAL CROPS. As noted above, airport operators often promote revenue-generating activities to supplement an airport's financial viability. A common concurrent use is agricultural crop production. Such use may create potential hazards to aircraft by attracting wildlife. Any proposed on-airport agricultural operations should be reviewed by a wildlife damage management biologist. FAA generally does not object to agricultural crop production on airports when: wildlife hazards are not predicted; the guidelines for the airport areas specified in 3-10.a-f. are observed; and the agricultural operation is closely monitored by the airport operator or sponsor to ensure that hazardous wildlife are not attracted.

NOTE: If wildlife becomes a problem due to on-airport agricultural operations, FAA recommends undertaking the remedial actions described in 3-10.f.

a. Agricultural activities adjacent to runways. To ensure safe, efficient aircraft operations, FAA recommends that no agricultural activities be conducted in the Runway Safety Area (RSA), OFA, and the OFZ (see AC 150/5300-13).

b. Agricultural activities in areas requiring minimum object clearances. Restricting agricultural operations to areas outside the RSA, OFA, OFZ, and Runway Visibility Zone (RVZ) (see AC 150/5300-13) will normally provide the minimum object clearances required by FAA's airport design

standards. FAA recommends that farming operations not be permitted within areas critical to the proper operation of localizers, glide slope indicators, or other visual or electronic navigational aids. Determinations of minimal areas that must be kept free of farming operations should be made on a case-by-case basis. If navigational aids are present, farm leases for on-airport agricultural activities should be coordinated with FAA's Airway Facilities Division, in accordance with FAA Order 6750.16, *Siting Criteria for Instrument Landing Systems.*

NOTE: Crop restriction lines conforming to the dimensions set forth in Table 2 will normally provide the minimum object clearance required by FAA airport design standards. The presence of navigational aids may require expansion of the restricted area.

c. Agricultural activities within an airport's approach areas. The RSA, OFA, and OFZ all extend beyond the runway shoulder and into the approach area by varying distances. The OFA normally extends the farthest and is usually the controlling surface. However, for some runways, the TSS (see AC 150/5300-13, Appendix 2) may be more controlling than the OFA. The TSS may not be penetrated by any object. The minimum distances shown in Table 2 are intended to prevent penetration of the OFA, OFZ, or TSS by crops or farm machinery.

NOTE: Threshold Siting standards should not be confused with the approach areas described in Title 14, Code of Federal Regulations, Part 77, (14 CFR 77), *Objects Affecting Navigable Airspace.*

d. Agricultural activities between intersecting runways. FAA recommends that no agricultural activities be permitted within the RVZ. If the terrain is sufficiently below the runway elevation, some types of crops and equipment may be acceptable. Specific determinations of what is permissible in this area requires topographical data. For example, if the terrain within the RVZ is level with the runway ends, farm machinery or crops may interfere with a pilot’s line-of-sight in the RVZ.

e. Agricultural activities in areas adjacent to taxiways and aprons. Farming activities should not be permitted within a taxiway's OFA. The outer portions of aprons are frequently used as a taxilane and farming operations should not be permitted within the OFA. Farming operations should not be permitted between runways and parallel taxiways.

f. Remedial actions for problematic agricultural activities. If a problem with hazardous wildlife develops, FAA recommends that a professional wildlife damage management biologist be contacted and an on-site inspection be conducted. The biologist should be requested to determine the source of the hazardous wildlife attraction and suggest remedial action. Regardless of the source of the attraction, prompt remedial actions to protect aviation safety are recommended. The remedial actions may range from choosing another crop or farming technique to complete termination of the agricultural operation.

Whenever on-airport agricultural operations are stopped due to wildlife hazards or annual harvest, FAA recommends plowing under all crop residue and harrowing the surface area smooth. This will reduce or eliminate the area's attractiveness to foraging wildlife. FAA recommends that this requirement be written into all on-airport farm use contracts and clearly understood by the lessee.

Table 2. Minimum Distances Between Certain Airport Features And Any On-Airport Agriculture Crops.

Aircraft Approach Category And Design Group [1]	Distance In Feet From Runway Centerline To Crop		Distance In Feet From Runway End To Crop		Distance In Feet from Centerline Of Taxiway To Crop	Distance In Feet from Edge Of Apron To Crop
	Visual & ≥ ¾ mile	< ¾ mile	Visual & ≥ ¾ mile	< ¾ mile		
Category A & B Aircraft						
Group I	200 [2]	400	300[3]	600	45	40
Group II	250	400	400[3]	600	66	53
Group III	400	400	600	300	93	31
Group IV	400	400	1,000	1,000	130	113
Category C, D & E Aircraft						
Group I	530[3]	575[3]	1,000	1,000	45	40
Group II	530[3]	575[3]	1,000	1,000	66	53
Group III	530[3]	575[3]	1,000	1,000	93	31
Group IV	530[3]	575[3]	1,000	1,000	130	113
Group V	530[3]	575[3]	1,000	1,000	160	133
Group VI	530[3]	575[3]	1,000	1,000	193	167

1. Design Groups are based on wing span, and Category depends on approach speed of the aircraft.

Group I: Wing span up to 49 ft.	Category A: Speed less than 91 knots
Group II Wing span 49ft. up to 73 ft.	Category B: Speed 91 knots up to 120 knots
Group III: Wing span 79 ft. up to 117 ft.	Category C: Speed 121 knots up to 140 knots
Group IV: Wing span 113 ft. up to 170 ft.	Category D: Speed 141 knots up to 165 knots
Group V: Wing span 171 ft. up to 213 ft.	Category E: Speed 166 knots or more
Group VI: Wing span 214 ft. up to 261 ft.	

2. If the runway will only serve small airplanes (12,500 lb. And under) in Design Group I, this dimension may be reduced to 125 feet; however, this dimension should be increased where necessary to accommodate visual navigational aids that may be installed. For example farming operations should not be allowed within 25 feet of a Precision Approach Path Indicator (PAPI) light box.

3. These dimensions reflect the TSS as defined in AC 150/5300-13, Appendix 2. The TSS cannot be penetrated by any object. Under these conditions, the TSS is more restrictive than the OFA, and the dimensions shown here are to prevent penetration of the TSS by crops and farm machinery.

SECTION 4. NOTIFICATION OF FAA ABOUT HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AN AIRPORT.

4-1. GENERAL. Airport operators, land developers, and owners should notify the FAA in writing of known or reasonably foreseeable land use practices on or near airports that either attract or may attract hazardous wildlife. This section discusses those notification procedures.

4-2. NOTIFICATION REQUIREMENTS FOR WASTE DISPOSAL SITE OPERATIONS. The Environmental Protection Agency (EPA) requires any operator proposing a new or expanded waste disposal operation within 5 statute miles of a runway end to notify the appropriate FAA Regional Airports Division Office and the airport operator of the proposal (40 CFR 253*, Criteria for Municipal Solid Waste Landfills*, section 253.10, *Airport Safety*). The EPA also requires owners or operators of new municipal solid waste landfill (MSWLF) units, or lateral expansions of existing MSWLF units that are located within 10,000 feet of any airport runway end used by turbojet aircraft or within 5,000 feet of any airport runway end used only by piston-type aircraft, to demonstrate successfully that such units are not hazards to aircraft.

a. Timing of Notification. When new or expanded MSWLFs are being proposed near airports, MSWLF operators should notify the airport operator and the FAA of this as early as possible pursuant to 40 CFR Part 253. Airport operators should encourage the MSWLF operators to provide notification as early as possible.

NOTE: AC 150/5000-3 provides information on these FAA offices.

b. Putrescible-Waste Facilities. In their effort to satisfy the EPA requirement, some putrescible-waste facility proponents may offer to undertake experimental measures to demonstrate that their proposed facility will not be a hazard to aircraft. To date, the ability to sustain a reduction in the numbers of hazardous wildlife to levels that existed before a putrescible-waste landfill began operating has not been successfully demonstrated. For this reason, demonstrations of experimental wildlife control measures should not be conducted in active aircraft operations areas.

c. Other Waste Facilities. To claim successfully that a waste handling facility sited within the separations identified in the siting criteria in 1-3 does not attract hazardous wildlife and does not threaten aviation, the developer must establish convincingly that the facility will not handle putrescible material other than that as outlined in 3-2. FAA requests that waste site developers provide a copy of an official permit request verifying that the facility will not handle putrescible material other than that as outlined in 3-2. FAA will use this information to determine if the facility will be a hazard to aviation.

4-3. NOTIFYING FAA ABOUT OTHER WILDLIFE ATTRACTANTS. While U.S. EPA regulations require landfill owners to provide notification, no similar regulations require notifying FAA about changes in other land use practices that can create hazardous wildlife attractants. Although it is not required by regulation, FAA requests those proposing land use changes such as those discussed in 2-3, 2-4, and 2-5 to provide similar notice to the FAA as early in the development process as possible. Airport operators that become aware of such proposed development in the vicinity of their airports should also notify the FAA. The notification process gives the FAA an opportunity to evaluate the effect of a particular land use change on aviation safety.

The land use operator or project proponent may use FAA Form 7460-1, *Notice of Proposed Construction or Alteration*, or other suitable documents to notify the appropriate FAA Regional Airports Division Office.

It is helpful if the notification includes a 15-minute quadrangle map of the area identifying the location of the proposed activity. The land use operator or project proponent should also forward specific details of the proposed land use change or operational change or expansion. In the case of solid waste landfills, the information should include the type of waste to be handled, how the waste will be processed, and final disposal methods.

4-5. FAA REVIEW OF PROPOSED LAND USE CHANGES.

a. The FAA discourages the development of facilities discussed in section 2 that will be located within the 5,000/10,000-foot criteria in 1-3.

b. For projects which are located outside the 5,000/10,000-foot criteria, but within 5 statute miles of the airport's aircraft movement areas, loading ramps, or aircraft parking areas, FAA may review development plans, proposed land use changes, operational changes, or wetland mitigation plans to determine if such changes present potential wildlife hazards to aircraft operations. Sensitive airport areas will be identified as those that lie under or next to approach or departure airspace. This brief examination should be sufficient to determine if further investigation is warranted.

c. Where further study has been conducted by a wildlife damage management biologist to evaluate a site's compatibility with airport operations, the FAA will use the study results to make its determination.

d. FAA will discourage the development of any excepted sites (see Section 3) within the criteria specified in 1-3 if a study shows that the area supports hazardous wildlife species.

4-6. AIRPORT OPERATORS. Airport operators should be aware of proposed land use changes, or modification of existing land uses, that could create hazardous wildlife attractants within the separations identified in the siting criteria in 1-3. Particular attention should be given to proposed land uses involving creation or expansion of waste water treatment facilities, development of wetland mitigation sites, or development or expansion of dredge spoil containment areas.

a. AIP-funded airports. FAA recommends that operators of AIP-funded airports, to the extent practicable, oppose off-airport land use changes or practices (within the separations identified in the siting criteria in 1-3) that may attract hazardous wildlife. Failure to do so could place the airport operator or sponsor in noncompliance with applicable grant assurances. FAA recommends against the placement of airport development projects pertaining to aircraft movement in the vicinity of hazardous wildlife attractants. Airport operators, sponsors, and planners should identify wildlife attractants and any associated wildlife hazards during any planning process for new airport development projects.

b. Additional coordination. If, after the initial review by FAA, questions remain about the existence of a wildlife hazard near an airport, the airport operator or sponsor should consult a wildlife damage management biologist. Such questions may be triggered by a history of wildlife strikes at the airport or the proximity of the airport to a wildlife refuge, body of water, or similar feature known to attract wildlife.

c. Specialized assistance. If the services of a wildlife damage management biologist are required, FAA recommends that land use developers or the airport operator contact the appropriate state director of the United States Department of Agriculture/Animal Damage Control (USDA/ADC), or a consultant specializing in wildlife damage management. Telephone numbers for the respective USDA/ADC state offices may be obtained by contacting USDA/ADC's Operational Support Staff, 4700 River Road, Unit 37, Riverdale, MD, 20737-1234, Telephone (301) 734-7921, Fax (301) 734-5157. The ADC biologist or consultant should be requested to identify and quantify wildlife common to the area and evaluate the potential wildlife hazards.

d. Notifying airmen. If an existing land use practice creates a wildlife hazard, and the land use practice or wildlife hazard cannot be immediately eliminated, the airport operator should issue a Notice to Airmen (NOTAM) and encourage the land owner or manager to take steps to control the wildlife hazard and minimize further attraction.

APPENDIX 1. DEFINITIONS OF TERMS USED IN THIS ADVISORY CIRCULAR.

1. GENERAL. This appendix provides definitions of terms used throughout this AC.

a. Aircraft movement area. The runways, taxiways, and other areas of an airport which are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft exclusive of loading ramps and aircraft parking areas.

b. Airport operator. The operator (private or public) or sponsor of a public use airport.

c. Approach or departure airspace. The airspace, within 5 statute miles of an airport, through which aircraft move during landing or takeoff.

d. Concurrent use. Aeronautical property used for compatible non-aviation purposes while at the same time serving the primary purpose for which it was acquired; and the use is clearly beneficial to the airport. The concurrent use should generate revenue to be used for airport purposes (see Order 5190.6A, *Airport Compliance Requirements*, sect. 5h).

e. Fly ash. The fine, sand-like residue resulting from the complete incineration of an organic fuel source. Fly ash typically results from the combustion of coal or waste used to operate a power generating plant.

f. Hazardous wildlife. Wildlife species that are commonly associated with wildlife-aircraft strike problems, are capable of causing structural damage to airport facilities, or act as attractants to other wildlife that pose a wildlife-aircraft strike hazard.

g. Piston-use airport. Any airport that would primarily serve FIXED-WING, piston-powered aircraft. Incidental use of the airport by turbine-powered, FIXED-WING aircraft would not affect this designation. However, such aircraft should not be based at the airport.

h. Public-use airport. Any publicly owned airport or a privately-owned airport used or intended to be used for public purposes.

i. Putrescible material. Rotting organic material.

j. Putrescible-waste disposal operation. Landfills, garbage dumps, underwater waste discharges, or similar facilities where activities include processing, burying, storing, or otherwise disposing of putrescible material, trash, and refuse.

k. Runway protection zone (RPZ). An area off the runway end to enhance the protection of people and property on the ground (see AC 150/5300-13). The dimensions of this zone vary with the design aircraft, type of operation, and visibility minimum.

l. Sewage sludge. The de-watered effluent resulting from secondary or tertiary treatment of municipal sewage and/or industrial wastes, including sewage sludge as referenced in U.S. EPA's *Effluent Guidelines and Standards*, 40 C.F.R. Part 401.

m. Shoulder. An area adjacent to the edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface, support for aircraft running off the pavement, enhanced drainage, and blast protection (see AC 150/5300-13).

n. Turbine-powered aircraft. Aircraft powered by turbine engines including turbojets and turboprops but excluding turbo-shaft rotary-wing aircraft.

o. Turbine-use airport. Any airport that ROUTINELY serves FIXED-WING turbine-powered aircraft.

p. Wastewater treatment facility. Any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes, including Publicly Owned Treatment Works (POTW), as defined by Section 212 of the Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-576) and the Water Quality Act of 1937 (P.L. 100-4). This definition includes any pretreatment involving the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW. (See 40 C.F. R. Section 403.3 (o), (p), & (q)).

q. Wildlife. Any wild animal, including without limitation any wild mammal, bird, reptile, fish, amphibian, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, including any part, product, egg, or offspring there of (50 CFR 10.12, *Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants*). As used in this AC, WILDLIFE includes feral animals and domestic animals while out of the control of their owners (14 CFR 139.3, *Certification and Operations: Land Airports Serving CAB-Certificated Scheduled Air Carriers Operating Large Aircraft (Other Than Helicopters)*).

r. Wildlife attractants. Any human-made structure, land use practice, or human-made or natural geographic feature, that can attract or sustain hazardous wildlife within the landing or departure airspace, aircraft movement area, loading ramps, or aircraft parking areas of an airport. These attractants can include but are not limited to architectural features, landscaping, waste disposal sites, wastewater treatment facilities, agricultural or aquacultural activities, surface mining, or wetlands.

s. Wildlife hazard. A potential for a damaging aircraft collision with wildlife on or near an airport (14 CFR 139.3).

2. RESERVED.

APPENDIX D

FAA, OFFICE OF AIRPORT SAFETY AND STANDARDS

PROGRAM POLICIES AND GUIDANCE

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Initiation of Ecological Studies at Airports.
AIRPORT CERTIFICATION PROGRAM - 14 CFR 139
PROGRAM POLICY AND GUIDANCE
POLICY # 53

139.337 April 25, 1997

SUBJECT : INITIATION OF ECOLOGICAL STUDIES AT AIRPORTS.

PURPOSE

This policy establishes the procedures Federal Aviation Administration (FAA) Airport Certification Safety Inspectors (ACSI) should follow when it is determined that an airport needs to conduct an ecological study to address an airport wildlife hazard.

BACKGROUND

Populations of wildlife species commonly associated with wildlife/aircraft strikes are increasing at a marked rate in the United States. For example, the resident Canada goose population increased 3-fold from 1935-1995; white-tailed deer populations increased 100-fold between 1900 and 1995; and gull populations on the Great Lakes increased 20-fold from 1950-1990. The presence of wildlife on and near airports creates a hazard to operating aircraft. Wildlife/aircraft strikes cause severe damage to operating aircraft, human injuries and loss of life. It is estimated that between 1993 and 1995, wildlife strikes cost U.S. civil aviation over $150 million annually. Military losses are estimated at over $100 million/year.

Title 14, Code of Federal Regulations, part 139.337 requires the certificate holder to conduct an ecological study[1], acceptable to the FAA, when a wildlife hazard exist on the airport. This study is used by the FAA to determine if a Wildlife Hazard Management Plan is needed for the airport. A Memorandum of Understanding (MOU) between the FAA and WS (No. 12-34-71-0003-MOU) establishes a cooperative relationship between these agencies for resolving wildlife hazards to aviation. The FAA relies heavily on the assistance of WS to conduct, review, or contribute to, airport ecological studies and airport Wildlife Hazard Management Plans.

[1] USDA, Wildlife Services, uses the term “Wildlife Hazard Assessment." 14 CFR 139.337(a) uses the term "Ecological Study." In this context the two terms should be considered synonymous. Wildlife Hazard Assessment is the preferred term because it is more descriptive of what is actually being done.

PROCEDURES

When the FAA determines that a ecological study is needed for a particular airport, the ACSI should:

1. Contact the appropriate airport official and inform them of the need for the study.

   The certificate holder may look to WS or to a private party to conduct the required ecological study. The certificate holder is responsible for consultant selection and initial contact. Because the ecological study is used by the FAA to determine if a Wildlife Hazard Management Plan is needed for the airport, it should be conducted by persons having the education, training, and experience necessary to adequately assess any wildlife hazards.

2. Give the airport sufficient time (normally no more than 30 days) to make the initial contact and set a date when the study will begin.

3. Review the airport's certification manual (ACM) to determine what procedures are already in place to meet section 139.337 requirements and the degree of compliance on the part of the airport. Failure of the certificate holder to fully comply with all part 139 requirements is a violation of the regulation.

4. Take follow-up actions as needed to insure timely initiation and completion of the study, as well as submission of the study results and recommendations.

5. Review the study and recommendations to determine if an airport Wildlife Hazard Management Plan is needed. Upon completion of the review process, convey the determination to the certificate holder.

OSB	April 25, 1997
Robert E. David, Manager	Date

SECTION 7 CONSULTATION ON ENDANGERED OR THREATENED SPECIES
AIRPORT CERTIFICATION PROGRAM - 14 CFR 139
PROGRAM POLICY AND GUIDANCE
POLICY # 57

139.337 March 19, 1993

SUBJECT: SECTION 7 CONSULTATION ON ENDANGERED OR THREATENED SPECIES.

PURPOSE:

This policy establishes the procedures for coordinating and documenting Federal Aviation Administration (FAA) compliance with the Endangered Species Act when requiring an airport operator to develop, submit for approval, and implement a Wildlife Hazard Management Plan.

BACKGROUND

Section 7(a)(2) of the Endangered Species Act of 1973, as amended, (16 U.S.C. 1531 *et seq.*) states, in part, that each Federal agency shall, in consultation with and with the assistance of the Secretary of Interior, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any Federally-listed or proposed endangered or threatened species, or result in the destruction or adverse modification of designated or proposed critical habitat.

The FAA's action in requiring an airport operator to develop, submit for approval, and implement a Wildlife Hazard Management Plan is considered a Federal action, as defined in the Endangered Species Act, and therefore, subject to section 7 consultation with the U.S. Fish and Wildlife Service (USFWS).

PROCEDURES

Under FAR 139.337(d)(1), the FAA may direct an airport operator to develop a Wildlife Hazard Management Plan or to update an existing plan. In these instances, the FAA Regional Coordinator (usually the Airport Certification Safety Inspector responsible for wildlife hazards) shall contact and request information from the local USFWS Ecological Services Field Office regarding the presence of Federally-listed or proposed species or designated or proposed critical habitat occurring on or near the airport. Form letter #1 (attached) shall be used to make this request.

No Further Coordination is Required.

If the USFWS indicates there are no Federally-listed or proposed species or designated or proposed critical habitat occurring on or near the airport, no further action is required regarding the section 7 consultation.

- Further Coordination is Required.

If the USFWS indicates that Federally-listed or proposed species or designated or proposed critical habitat occur on or near the airport, the following additional actions must be taken.

1) The FAA Regional Coordinator shall forward the information regarding the presence of Federally-listed or proposed species or designated or proposed critical habitat to the airport so it can take this information into consideration when developing its Wildlife Hazard Management Plan.

   a) The airport operator must prepare a Biological Assessment (50 CFR 402.13) assessing the affects of the Wildlife Hazard Management Plan on the Federally-listed or proposed species or designated or proposed critical habitat. The Biological Assessment must be submitted to FAA along with the draft plan.

   b) The airport operator may request early consultation if it has reasons to believe some of the actions proposed under the Wildlife Hazard Management Plan may affect Federally-listed or proposed species or designated or proposed critical habitat.

2) When the plan is submitted to the FAA for review and approval, the FAA Regional Coordinator must contact the local USFWS Ecological Services Field Office responsible for section 7 consultations and request consultation on the plan. Form letter #2 (attached) shall be used to submit the Wildlife Hazard Management Plan to USFWS ES for section 7 consultation.

3) The section 7 consultation must be completed before the Wildlife Hazard Management Plan is given final FAA approval and returned to the airport operator for inclusion in its Airport Certification Manual and implementation.

4) The signature level for both letters is at the discretion of the FAA Regional Office.

OSB	March 19, 1993
Robert E. David, Manager	Date

FORM LETTER #1

Request for information regarding the presence of Federally-listed or proposed species or designated or proposed critical habitat.

Because of recent wildlife aircraft strikes at _____ Airport in _____County, ____(State), the Federal Aviation Administration (FAA) is requiring the airport develop a Wildlife Hazard Management Plan to reduce the wildlife aircraft strike hazard at the airport.

As part of the Wildlife Hazard Management Plan developmental process, potential impact on federally-listed or proposed species or designated or proposed critical habitat will be considered. Therefore, would you provide information concerning the presence of federally-listed or proposed species or designated or proposed critical habitat occurring on or near the airport?

Please reply to the attention of _____, [and reference file no. _____].

Thank you for your cooperation in this matter.

FORM LETTER #2

Request for Section 7 Consultation.

At the direction of the Federal Aviation Administration (FAA), _____ Airport in _____County, ____(State), has developed the attached Wildlife Hazard Management Plan, which is intended to mitigate wildlife aircraft strike hazards at the airport.

The actions proposed in the plan may include:

1. Habitat modifications - reduction/elimination of food, cover, and water attractive to certain wildlife species.
2. Resource protection - repelling of certain wildlife species using physical barriers and/or chemical, audio, and/or visual repellents.
3. Population management - removal of certain wildlife species from the vicinity of the airport using non-lethal and lethal means.

In accordance with Section 7 of the Endangered Species Act of 1973, as amended, the FAA has reviewed the draft plan and has determined that the plan is/is not *(select one; consult the FAA Staff Wildlife Biologist if assistance is needed in making the determination of effect.)* likely to adversely affect the following federally-listed or proposed species or designated or proposed critical habitat: *(list federally-listed or proposed species or designated or proposed critical habitat from information provided by USFWS ES, in response to form letter #1).*

Please reply to the attention of _____, [and reference file no. _____].

Thank you for your cooperation in this matter.

Airport Certification Program - 14 CFR Part 139
Program Policy and Guidance
Policy # 64

139.337

SUBJECT: REVIEW OF AIRPORT WILDLIFE HAZARD MANAGEMENT PLANS.

PURPOSE

This policy establishes procedures Airport Certification Safety Inspectors must follow when an incident occurs that requires an operator of a certificated airport to initiate an ecological study[1], as mandated under Title 14, Code of Federal Regulations, §139.337(a)(1-3).

BACKGROUND

Part 139.337 prescribes action that a certificate holder must take in response to certain wildlife events. As a reminder, the requirements states:

Each certificate holder shall provide for the conduct of an ecological study, acceptable to the Administrator, when any of the following events occurs on or near the airport:

1. An air carrier aircraft experiences a multiple bird strike or engine ingestion;
2. An air carrier aircraft experiences a damaging collision with wildlife other than birds;
3. Wildlife of a size or in numbers capable of causing an event described in paragraph (a)(1) or (2) of this section is observed to have access to any airport flight pattern or movement area.

Recent strike reports received by the Airport Safety and Certification Branch (AAS-310) have raised questions regarding compliance with the standards of §139.337. To resolve this matter, Airport Certification Safety Inspectors shall implement the following procedures when notified of any of the events listed in §139.337 (a)(1-3). These procedures are intended to ensure that certificate holders take appropriate action in response to wildlife strikes/incidents and that the FAA consistently maintains records of actions taken.

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[1] USDA, Wildlife Services, uses the term “wildlife hazard assessment." 14 CFR 139.337(a) uses the term "ecological study." In this context the two terms should be considered synonymous. Wildlife hazard assessment is the preferred term because it is more descriptive of what is actually being done.

PROCEDURES.

1) AAS-310 will review all reports of aircraft wildlife strikes. When a strike is reported that would initiate an ecological study under §139.337(a)(1-3), a copy of the report, together with the strike history of the airport in question, will be forwarded to the Regional Coordinator, usually the Airport Certification Safety Inspector responsible for that region's wildlife hazard management issues.

2) When notification is received from AAS-310, the Regional Coordinator will review the specific airport's Airport Certification Manual to determine if an ecological study (Wildlife Hazard Assessment) has ever been conducted at the airport, and if the results of that study led to the development and implementation of an FAA approved Wildlife Hazard Management Plan.

   a) If an ecological study has never been conducted, the Regional Coordinator will instruct the certificate holder to undertake the required ecological study. Procedures found in Program Policy and Guidance Policy # 53, Initiation of Ecological Studies at Airports should be followed. The results of this study, together with other pertinent factors, will be used to determine if a Wildlife Hazard Management Plan is needed.

   b) If an ecological study was conducted within the last 12 months, but development and implementation of a Wildlife Hazard Management Plan was not required, Regional Coordinator will review the ecological study and the decision not to require development and implementation of a Wildlife Hazard Management Plan. In most cases, the certificate holder should be instructed to develop and submit for FAA approval a Wildlife Hazard Management Plan based on the results of the ecological study.

   c) If the ecological study is more than 12 months old, and no Wildlife Hazard Management Plan was developed, the Regional Coordinator will instruct the certificate holder to begin a new ecological study. The results of this study, together with other pertinent factors, will be used to determine if a Wildlife Hazard Management Plan is needed.

   d) If a FAA approved Wildlife Hazard Management Plan is in place; the Plan should be reviewed to insure that it meets all requirements of §139.337(e). Certalert 97-09, Wildlife Hazard Management Plan Outline provides guidance on what should be in an airport's Wildlife Hazard Management Plan.

   e) If the Wildlife Hazard Management Plan does not meet all requirements of §139.337(e), the Regional Coordinator will instruct the certificate holder to bring the Plan into compliance with §139.337(e). In some cases, it may be necessary for the certificate holder to under take a new ecological study.

f) If the Wildlife Hazard Management Plan does meet all requirements of §139.337(e), the Regional Coordinator will instruct the certificate holder to review the Plan and determine if it needs revision. This review is best conducted with the assistance of a Wildlife Damage Management Biologist.

Following the review, the certificate holder must notify the FAA of the results of their review and any proposed corrective actions or changes to their Wildlife Hazard Management Plan. When approved, amendments shall be incorporated in the Airport Certification Manual.

3) As a reminder, Airport Certification Safety Inspectors will, as part of the initial or periodic inspection, review an airport's Wildlife Hazard Management Plan to ensure that is meets all requirements of §139.337(e)

Further, Airport Certification Safety Inspectors will also review remarks on wildlife hazards in the Airport Facility Directory (AFD), Notice to Airmen (NOTAM) system, or the Automatic Terminal Information Service (ATIS). If these remarks warn of wildlife hazards at or around the airport, the Airport Certification Safety Inspector will consider such remarks to have met the criteria of §139.337(a)(3), and therefore will require the certificate holder to conduct an ecological study, if such a study has not been previously conducted. The results of the ecological study will be used to determine if a Wildlife Hazard Management Plan is needed.

OSB	10/04/99
Robert E. David, Manager	Date

Airport Certification Program – CFR Part 139
Program Policy and Guidance
Policy # 65

139.337

SUBJECT: WASTE DISPOSAL FACILITY COORDINATION.

Purpose

This policy establishes the procedures for coordinating and documenting Federal Aviation Administration (FAA) determinations on developing new or expanding existing waste disposal sites within 5 miles of a public-use airport. Guidance on siting various types of landfills is provided in FAA Advisory Circular 150/5200-33 – Hazardous Wildlife Attractants on or Near Airports.

BACKGROUND

The increasing pressure to develop new or expand existing waste disposal sites necessitates coordinating responses to ensure that the agency has a consistent response to these proposals. This practice has been in effect in the Great Lakes and Southwest Regions for several years and has worked well.

PROCEDURES

When a landfill proponent notifies FAA, under Title 40, Code of Federal Regulations, part 258.10, of a proposal to establish a new or expand an existing landfill, the Regional Coordinator, usually the Airport Certification Safety Inspector (ACSI), responsible for waste disposal and wildlife hazards in that region will:

1. Evaluate the proposal and determine whether on not it is compatible with the provisions of AC 150/5200-33 and safe airport operations;

2. Complete a copy of the attached Waste Disposal Facility Coordination Form, based on that determination, including any recommended permitting conditions;

3. Forward the completed form, together with any supporting material to the FAA Staff Wildlife Biologist for evaluation and coordination.

4. If the potentially effected airport is a joint use facility with military aviation, a courtesy copy of the completed form, together with any supporting material should be forwarded to the FAA regional military liaison.

Any disagreement between the recommendations of the Regional Coordinator and the Staff Wildlife Biologist will be resolved by consultation between the Region and

Headquarters. When agreement is reached, the Staff Wildlife Biologist will sign the Coordination Form and return a copy to the Regional Coordinator.

All applicable recommended permitting conditions (Section 4 of the Waste Disposal Facility Coordination Form) should be included in the Letter of Determination sent to the proponent or state agency. The completed form will be made a part of the region's permanent file.

OSB	9/17/99
Robert E. David, Manager	Date

Sample form

WASTE DISPOSAL/PROCESSING FACILITY (WD/WP) COORDINATION FORM

SECTION 1 – WASTE DISPOSAL/PROCESSING FACILITY (WD/WP) INFORMATION

Site / Facility Name:	File No:
Associated City / State:	

Check as appropriate

New Site:	Expand/Modify Existing Site**:**	Re-Permit Existing Site:	Other:
Sanitary Landfill:	Waste transfer Station:	Demolition/Construction Debris:	Recycling Center:
Compost facility:	Water Treatment/Oxidation:	Water Detention/Retention:	Other:

Circle as appropriate

Facility will process or store putrescible waste material outdoors:	**Y - N**		
Facility is within 5,000 feet of a public-use airport utilized by piston engine aircraft:	**Y - N**		
Facility is within 10.000 feet of a public-use airport utilized by turbine engine aircraft:	**Y - N**		
Facility is within a 5 mile radius of a public-use airport:	**Y - N**	Distance to nearest runway end (FT):	
Reported hazardous wildlife activity at airport:	**Y - N**	Reported hazardous wildlife activity at facility:	**Y - N**
State EPA licensing requirements:	**Y - N**	State EPA enforcement/mitigation procedures:	**Y - N**
USDA/WS evaluation conducted:	**Y - N**	Non-hazard: _____ Hazard: _____	(check one)

SECTION 2 – AIRPORT INFORMATION

Associated Public Use Airports:

LOC ID:	ATCT: **Y - N**	Military Aviation On-Site: **Y - N** (If yes, notify FAA regional military liaison)	
Type Airport: GA - Com Serv	Longest Runway (Ft):	Instrument Runway: **Y - N**	Jet fuel Available: **Y - N**
Total Annual Operations:	Piston Operations:	Turbine Operations:	

SECTIONS 3 – COMPATIBILITY

Proposed wildlife attraction is considered compatible with provisions of FAA AC 150/5200-33

Regional concurrence	non-concur:	Signature:	Date:
Supporting documentation, correspondence, site maps, etc., attached			
AAS-310 agree:	disagree:	Signature:	Date:

SECTIONS 4 – CONDITIONS FOR CONCURRENCE

	1	The WD/PF must be properly supervised to assure that bird populations are not increasing and that appropriate control procedures are being followed.
	2	Any increases in bird activity that might be hazardous to safe aircraft operations will result in prompt mitigation actions and/or closure of the WD/PF.
	3	Garbage shall not be handled or stored outside the WD/PF at any time, for any reason, or in a partially enclosed vehicle/structure that is accessible to birds or other wildlife.
	4	The WD/PF shall be totally enclosed and shall be operated without any outward indications that waste disposal operations are underway indoors.
	5	Only non-putrescible demolition/construction waste material will be accepted in the WD/PF.
	6	Only composting materials shall be accepted in the referenced WD/PF. No other putrescible materials shall be accepted.
	7	The above checked conditions must be clearly defined via state/local licensing procedures associated with establishment of the WD/PF.

SECTIONS 5 – COMMENTS

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APPENDIX E

FAA, OFFICE OF AIRPORT SAFETY AND STANDARDS

CERTALERTS

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C E R T A L E R T

ADVISORY * CAUTIONARY * NON-DIRECTIVE

FOR INFORMATION, CONTACT CERTIFICATION BRANCH, AAS-317 (202) 267.3339

DATE:	**APRIL 25, 1997**	**NO. 97-02**
TO:	**AIRPORT CERTIFICATION PROGRAM INSPECTORS**	
TOPIC:	**RELATIONSHIP BETWEEN FAA AND WS**	

The attached Certalert clarifies the roles of, and relationship between the Federal Aviation Administration (FAA) and the United States Department of Agriculture/ Animal and Plant Health Inspection Service/Animal Damage Control (WS) with regards to wildlife hazards on or near airports.

Robert E. David

Manager, Airport Safety and Compliance Date: April 25, 1997

CERTALERT DISTRIBUTION LIST

RELATIONSHIP BETWEEN FAA AND WS.

PURPOSE

This Certalert clarifies the roles of, and relationship between the Federal Aviation Administration (FAA) and the United States Department of Agriculture/ Animal and Plant Health Inspection Service/Animal Damage Control (WS) with regards to wildlife hazards on or near airports.

Federal Aviation Administration

The FAA issues airport operating certificates for airports serving certain air carrier aircraft under Title 14, Code of Federal Regulations, part 139. Section 139.337 requires certificated airports having a wildlife hazard problem to develop and implement a Wildlife Hazard Management Plan to manage and control wildlife which present a risk to public safety caused by aircraft collisions with wildlife. The FAA relies heavily on the assistance of WS to review and contribute to such plans.

Animal Damage Control

The Animal Damage Control Act of March 2, 1931, (7 USC 426-426c, as amended), charges the Secretary of Agriculture with management of wildlife injurious to agricultural interests, other wildlife, or human health and safety. Further, the Secretary is authorized to cooperate with States, individuals, public and private agencies, organizations, and institutions in the control of nuisance mammals and birds, including wildlife hazards to aviation. Because of the experience, training, and background of its personnel, WS is recognized throughout the world as an expert in dealing with wildlife damage management issues. WS has an active presence in all U.S. states and territories.

MEMORANDUM OF UNDERSTANDING

A Memorandum of Understanding (MOU) between the FAA and WS (No. 12-4-71-0003-MOU) establishes a cooperative relationship between these agencies for resolving wildlife hazards to aviation.

AGENCY FUNDING

Both agencies are funded by congressional appropriations. The majority of funding for the FAA comes from the Aviation Trust Fund with the remainder coming from the general funds of the U.S. Treasury. Any revenues generated by the FAA are returned to the U.S. Treasury. WS receives a limited amount of funds from the general fund of the U.S. Treasury that allows it to perform some services for the public good. However, WS's funding is also based upon its ability to enter into contracts to provide services and receive reimbursement for the cost of the services. Legislation allows WS to

collect this money and return it to the program rather than the general funds of the U.S. Treasury. Consequently, WS may enter into a cooperative service agreement with an airport operator for reimbursement of services to perform an ecological study[1] on an airport.

WILDLIFE HAZARD MANAGEMENT

14 CFR part 139.337 requires the certificate holder conduct an ecological study acceptable to the FAA Administrator, when any of the following events occur on or near the airport:

1. An air carrier aircraft experiences a multiple bird strike or engine ingestion, or
2. An air carrier aircraft experiences a damaging collision with wildlife other than birds, or
3. Wildlife of a size or in numbers capable of causing an event described in paragraph (1) or (2) is observed to have access to any airport flight pattern or movement area.

The ecological study shall contain at least the following:

1. Analysis of the event which prompted the study.
2. Identification of the species, numbers, locations, local movements, and daily and seasonal occurrences of wildlife observed.
3. Identification and location of features on and near the airport that attract wildlife.
4. Description of the wildlife hazard to air carrier operations.

The certificate holder may look to WS or to private consultants to conduct the required ecological study. However, because the FAA to determine if a Wildlife Hazard Management Plan is needed for the airport uses the ecological study, persons having the education, training, and experience necessary to adequately assess any wildlife hazards should conduct it.

WS may conduct preliminary Wildlife Hazard Assessments at no charge to the certificate holder, as WS's funding and personnel limitations permit. More detailed assessments may require the certificate holder to enter into a cooperative service agreement with WS.

[1] USDA, Wildlife Services, uses the term "Wildlife Hazard Assessment." 14 CFR 139.337(a) uses the term "Ecological Study." In this context the two terms should be considered synonymous. Wildlife Hazard Assessment is the preferred term because it is more descriptive of what is actually being done.

C E R T A L E R T

ADVISORY * CAUTIONARY * NON-DIRECTIVE

FOR INFORMATION, CONTACT AIRPORT WILDLIFE SPECIALIST, AAS-317 (202) 267.3339

DATE: **17 November, 1997** **No. 97-09**

TO: **AIRPORT CERTIFICATION SAFETY INSPECTORS**

TOPIC: **WILDLIFE HAZARD MANAGEMENT PLAN OUTLINE**

A increasing number of questions are being received concerning the preparation and content of an FAA approved airport Wildlife Hazard Management Plan. Title 14 Code of Federal Regulations, part 139.337, *Wildlife Hazard Management,* prescribes the specific issues that a Wildlife Hazard Management Plan must address for FAA approval and inclusion in the ACM.

A Wildlife Hazard Assessment, defined as an ecological study in part 139.337 (a), conducted by a wildlife damage management biologist, provides the scientific basis for the development , implementation, and refinement of a Wildlife Hazard Management Plan. Though parts of the Wildlife Hazard Assessment may be incorporated directly in the Wildlife Hazard Management Plan, they are two separate documents. Part of the Wildlife Hazard Management Plan can be prepared by the biologist(s) who conducts the Wildlife Hazard Assessment. However, some parts can be prepared only by the airport. For example, airport management assigns airport personnel responsibilities, commits airport funds, and purchases equipment and supplies. Airport management may request the wildlife biologist to review the finished plan.

The wildlife damage management biologist's primary responsibilities are:

- to provide information on the wildlife attractants that have been identified on or near the airport,
- to identify wildlife management techniques,
- to prioritize appropriate mitigation measures,
- to recommend necessary equipment and supplies, and
- to identify training requirements for the airport personnel who will implement the Wildlife Hazard Management Plan.

It is often helpful for the airport manager to appoint a Wildlife Hazard Management Group that has responsibility for the airport's wildlife management program. The

biologist should assist the Wildlife Hazard Management Group with periodic evaluations of the plan and make recommendations for further refinements or modifications.

The following details the requirements of part 139.337 (e) and (f) and how those requirements should be addressed in an FAA-approved Wildlife Hazard Management Plan.

14 CFR 139.337	Comments
139.337(e). The (wildlife hazard management) plan shall include at least the following :	The Wildlife Hazard Management Plan must include, and/or identify the responsibility of, and/or actions to be taken, –
139.337(e)(1). The persons who have authority and responsibility for implementing the plan.	Specific responsibilities for various sections of the Wildlife Hazard Management Plan must be assigned or delegated to various airport departments such as: Airport Director Operations Dept. Maintenance Dept. Security Dept. Planning Dept. Finance Dept. Wildlife Coordinator Wildlife Hazard Group Local law enforcement authorities that provide wildlife law enforcement and other support also have a role to play: State Fish and Game U.S. Fish and Wildlife Service City police County Sheriff
139.337(e)(2). Priorities for needed habitat modification and changes in land use identified in the ecological study with target dates for completion.	Attractants (food, cover, and water) identified in Wildlife Hazard Assessment, with priorities for mitigation and completion dates. Attractants can be grouped by areas and ownership. (A list of completed habitat modification or other projects designed to reduce the wildlife/aircraft strike potential can be included, and provides a history of work already accomplished.) Airport property: Aircraft Operations Area (AOA). Within 2 miles of aircraft movement areas. Within 5 miles of aircraft movement areas. Airport structures Non-airport property Within 2 miles of aircraft movement areas. Within 5 miles of aircraft movement areas. Structures

14 CFR 139.337	Comments
Habitat/population management recommendations	Management plans for specific areas, attractants, species, or situations, as identified in ecological study (Wildlife Hazard Assessment). This section may include any or all of the following: Food/Prey-base Management Rodents Earthworms Insects Other prey Trash and debris - handling, storage. Handouts Species specific population management i.e. deer, gulls, geese, coyotes Repelling Exclusion Removal Habitat Management Vegetation Management AOA vegetation Drainage ditch(s) vegetation Landscaping Agriculture Water Management Permanent Water Wetlands Canals/drainage ditches Detention/retention ponds Sewage (glycol) treatment ponds Other water areas Ephemeral water Runways, taxiways, & aprons. Other wet areas Airport Buildings Airfield structures Abandoned structures Terminal Airport construction Resource Protection Exclusion Repelling Chemical Auditory Visual

14 CFR 139.337	Comments
139.337(e)(3). Requirements for and, where applicable, copies of local, state and Federal wildlife control permits.	Wildlife can be protected at all levels of government – city, county, state, federal, or may not be protected at all, depending on location and species. Therefore the section should address the specific species involved and their legal status. Wildlife management permitting requirements and procedures (spelled out) Federal - 50 CFR parts 1 to 199. State - Fish and Game Code (or equivalent) City, county - ordinances If pesticides are to be used, then the following are also needed. Pesticide use regulations Federal- [Federal Insecticide, Fungicide, and Rodenticide Act, as amended (FIFRA)] State (varies by state) City/county (if applicable) Pesticide use licensing requirements State regulations
139.337(e)(4). Identification of resources to be provided by the certificate holder for implementation of the plan.	Lists identifying what the airport will supply in terms of: Personnel Time Equipment, (i.e. radios, vehicle(s), guns, and traps). Supplies (i.e. shellcrackers, mylar tape) Wildlife Patrol Personnel Vehicle(s) Equipment Supplies Pesticides Restricted/non-restricted Application equipment Sources of Supply
139.337(e)(5). Procedures to be followed during air carries operations, including at least…	
139.337(e)(5)(i). Assignment of personnel responsibilities for implementing the procedures;	Who, when, what circumstances Wildlife Patrol Wildlife Coordinator Operations Dept. Maintenance Dept. Security Dept. Air Traffic Control
139.337(e)(5)(ii). Conduct of physical inspections of the movement areas and other areas critical to wildlife hazard management sufficiently in advance of air carrier operations to allow time for wildlife controls to be effective;	Who, when, how, what circumstances -- Runway(s), taxiway(s), and ramp(s) sweeps, AOA monitoring Un-mitigated attractants

14 CFR 139.337	Comments
139.337(e)(5(iii). Wildlife control measures;	Who, what circumstances, when, how is the Wildlife Patrol contacted. Wildlife Patrol Bird Control repel capture kill Mammal control repel capture kill
139.337(e)(5)(iv). Communication between wildlife control personnel and any air traffic control tower in operation at the airport.	Communication procedures Training in communication procedures Equipment needed Radios, mobile phones, etc. Lights
139.337(e)(6). Periodic evaluation and review of the Wildlife Hazard Management Plan for:	At a minimum the airport operator should hold annual meetings, or after an event described in 139.337(a)(1 to 3), with representatives from all airport departments involved in the airport's wildlife hazard management efforts and the wildlife damage management biologist who did the original ecological study (Wildlife Hazard Assessment).
139.337(e)(6)(i). Effectiveness in dealing with the wildlife hazard;	Input from all airport departments, ATC, wildlife biologist, as to effectiveness of plan. Good records are a must for evaluating the effectiveness of a program. Therefore need to know what records are kept, by who, how, where, and when.
139.337(e)(6(ii). Indications that the existence of the wildlife hazard, as previously described in the ecological study, should be reevaluated.	Wildlife seen on AOA Request for wildlife dispersal from Tower, pilots, or others Wildlife strike database and other records. Good records are a must.
139.337(e)(7). A training program to provide airport personnel with the knowledge and skills needed to carry out the Wildlife Hazard Management Plan required by paragraph (d) of this section.	Wildlife Patrol personnel training All airport personnel – wildlife hazard awareness training Pesticide use training and certification

14 CFR 139.337	Comments
139.337(f). Notwithstanding the other requirements of this section, each certificate holder shall take immediate measures to alleviate wildlife hazards whenever they are detected.	Although not required as part of Wildlife Hazard Management Plan, this information should be included to fulfill part 139 requirements. Procedures and personnel responsibilities for notification regarding new or immediate hazards by and to: Wildlife Patrol Operations NOTAM issuance/cancellation criteria and procedures Maintenance Security Air Traffic Control Others Rapid response procedures for new or immediate hazards by: Wildlife Patrol Operations Maintenance Security Air Traffic Control Others
139.337(g). FAA Advisory Circulars in the 150 series contain standards and procedures for wildlife hazard management at airports, which are acceptable to the Administrator.	AC 150/5200--33 Hazardous Wildlife Attractants on or Near Airports.

Benedict D. Castellano, Manager
Airport Safety and Compliance Branch

C E R T A L E R T

ADVISORY CAUTIONARY NON-DIRECTIVE

FOR INFORMATION, CONTACT AIRPORT WILDLIFE SPECIALIST, AAS-317 (202) 267.3389

DATE: **September, 18, 1998** **No. 98-05**

TO: **Airport Operators,**
FAA Airport Certification Safety Inspectors

TOPIC: **Grasses Attractive To Hazardous Wildlife**

Recently, several reports have been received of airport owners or airport contractors planting disturbed areas (construction sites, re-grading projects, etc) with seed mixtures containing brown-top millet. All millets are a major attractant to doves and other seed eating birds.

Doves can be a major threat to aircraft safety. In the United States, between 1991 and 1997, doves were involved in 11% of all reported bird/aircraft strikes, 8% of the reported strikes that resulted in aircraft down time, and 8% of the reported strikes causing aircraft damage or other associated monetary losses.

Airport operators should ensure that grass species and other varieties of plants attractive to hazardous wildlife are not used on the airport. Disturbed areas or areas in need of re-vegetating should not be planted with seed mixtures containing millet or any other large-seed producing grass.

For airport property already planted with seed mixtures containing millet or other large-seed producing grasses, it is recommended that disking, plowing, or other suitable agricultural practice be employed to prevent plant maturation and seed head production.

For specific recommendations on grass management and seed selection, contact the State University Cooperative Extension Service, or the local office of the USDA, Wildlife Services.

OSB

Benedict D. Castellano, Manager
Airport Safety and Compliance Branch

September 18, 1998

APPENDIX F

USDA, WILDLIFE SERVICES DIRECTIVE 2.305,

WILDLIFE HAZARDS TO AVIATION

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United States Department of Agriculture
Animal and Plant Health Inspection Service

Wildlife Services Directive 2.305 4/15/98

WILDLIFE HAZARDS TO AVIATION

1. PURPOSE

To provide general guidelines for Wildlife Services (WS) technical and/or direct control assistance to airport managers, State aviation agencies, aviation industry, Federal Aviation Administration (FAA), and Department of Defense regarding hazards caused by wildlife to airport safety.

2. REPLACEMENT HIGHLIGHTS

This directive replaces ADC Directive 2.305 dated 04/05/95.

3. POLICY

WS will assist responsible Federal and State agencies, airport managers, and the aviation industry in reducing wildlife hazards to airports and air bases according to the APHIS/ADC [WS] Memorandum of Understanding with the FAA and the guidelines set forth in the WS Managing Wildlife Hazards at Airports Manual.

WS may enter into cooperative agreements to conduct wildlife hazard assessments and/or management plans for an airport or air base or to conduct direct control and/or technical assistance activities to minimize hazards caused by wildlife. These activities will be conducted under cooperative agreements fully funded by cooperating entities.

WS personnel may also provide specific training for airport and air base personnel in wildlife identification and the safe and proper use of wildlife damage management equipment and techniques. WS personnel will provide recommendations and assistance to airport managers and air base commanders in obtaining necessary Federal and State permits required to take protected wildlife species at airports and air bases.

Whenever WS personnel observe existing or potential wildlife hazards at airports or air bases, appropriate aviation authorities will be notified immediately.

4. REFERENCES

ADC Directive 2.620, ADC Aviation Safety and Operations
WS Managing Wildlife Hazards at Airports Manual
Memorandum of Understanding between APHIS and FAA (3/21/89)
14 CFR Part 139.337 Ä Wildlife Hazard Management

Deputy Administrator

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APPENDIX G

MEMORANDUM OF UNDERSTANDING

BETWEEN

UNITED SATES DEPARTMENT OF TRANSPORTATION,

FEDERAL AVIATION ADMINISTRATION (FAA)

and

UNITED STATES DEPARTMENT OF AGRICULTURE,

ANIMAL AND PLANT HEALTH INSPECTION SERVICE,

ANIMAL DAMAGE CONTROL (WILDLIFE SERVICES).

(No. 12-34-71-0003-MOU)

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No. 12-34-71-0003-MOU

MEMORANDUM OF UNDERSTANDING
BETWEEN
UNITED STATES DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION (FAA)
and
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL DAMAGE CONTROL (ADC)

ARTICLE 1

This Memorandum of Understanding (MOU) establishes a cooperative relationship between FAA and ADC for resolving animal hazards to aviation that benefits public safety.

ARTICLE 2

This MOU is reached pursuant to the Animal Damage Control Act of March 2, 1931, (7USC 426-426b), and The Rural Development, Agriculture, and Related Agencies Appropriations Act, 1988 (P.L. 100-202), which established the authority of the Secretary of Agriculture to cooperate with States, individuals, public and private agencies, organizations, and institutions in the control of nuisance mammals and birds deemed injurious to the public.

The Administrator of the FAA is empowered to issue airport operating certificates for airports serving air carrier aircraft and certifies that such airports are properly and adequately equipped, and able to conduct safe operations, pursuant to the Federal Aviation Act of 1958, (49USC 1432), as amended. Federal Aviation Regulation (14 CFR Part 139) requires certificated airports having a wildlife hazard problem to develop and implement a wildlife hazard management plan to manage and control wildlife which present a risk to public safety caused by aircraft collisions with wildlife. “Wildlife hazard" has been defined as a potential for a damaging aircraft collision with wildlife, on or near an airport.

ARTICLE 3

FAA and ADC agrees:

a. That ADC has the expertise to provide technical and operational assistance needed to reduce wildlife hazards to aviation on and near airports.

b. That most airports lack the technical expertise to identify underlying causes of wildlife hazard problems, but do have the capability to control their own wildlife, following proper instruction in control techniques.

c. That situations arise where nuisance wildlife control is necessary off airport property (roost relocations, reductions in nesting populations, etc.) requiring specialized technical assistance of ADC personnel.

d. That FAA or the certificated airport may request technical and operational assistance from ADC to reduce wildlife hazards. This assistance includes, but is not limited to, site visits to identify wildlife and their movement patterns and habitats which increase the risk of animal and aviation conflicts. ADC personnel may also provide, (1) recommendations on control and habitat management to minimize the hazards, (2) training in the use of control devices, and (3) recommendations on the scope of further studies necessary to identify and minimize wildlife hazards.

e. ADC shall not be liable or responsible for development, approval, or implementation of wildlife hazard management plans required under FAR Part 139.337, this being the responsibility of the airport operator. Information provided by ADC as a result of site visits or consultation shall be used by the airport operator in developing the wildlife hazard management plan.

f. To meet at least annually to review this agreement, identify problems, exchange information on new control methodologies, identify research needs, and prioritize program needs.

ARTICLE 4

All animal damage control activities will be conducted in accordance with applicable Federal, State, and local laws and regulations. ADC personnel shall advise airport operators of their responsibilities to secure necessary permits and/or licenses for control of wildlife.

ARTICLE 5

This MOU defines in general terms, the basis on which the parties will cooperate, and does not constitute a financial obligation to serve as a basis for expenditures. Request for technical, operational, or research assistance which require cooperative or reimbursable funding will be completed under a separate agreement.

ARTICLE 6

This MOU shall supersede all existing MOU's, supplements, and amendments relating to the conduct of animal damage control programs between ADC and FAA.

ARTICLE 7

Pursuant to Section 22, title 41, United States Code, no member of or delegate to Congress shall be admitted to any share or part of this MOU, or to any benefit to arise therefrom.

ARTICLE 8

This MOU shall become effective upon the date of final signature and shall continue indefinitely. This Memorandum may be amended at any time by mutual agreement of the parties in writing. It may be terminated by either party upon 60 days advance written notice to the other party.

APR 13, 1989
Date

Administrator
U.S. Department of Transportation
Federal Aviation Administration

MAR 21, 1989
Date

Acting Administrator
U.S. Department of Agriculture
Animal and Plant Health Inspection

APPENDIX H

FAA FORM 5200-7

BIRD/OTHER WILDLIFE STRIKE REPORT

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Form Approved OMB NO. 2120-0018

U.S. Department of Transportation
Federal Aviation Administration

BIRD/OTHER WILDLIFE STRIKE REPORT

1. Name of Operator

2. Aircraft Make/Model

3. Engine Make/Model

4. Aircraft Registration

5. Date of Incident
_____/_____/_____
Month Day Year

6. Local Time of Incident
☐ Dawn ☐ Dusk — HR — MIN
☐ Day ☐ Night ☐ AM ☐ PM

7. Airport Name

8. Runway Used

9. Location if En Route *(Nearest Town/Reference & State)*

10. Height *(AGL)*

11. Speed *(IAS)*

12. Phase of Flight
☐ A. Parked
☐ B. Taxi
☐ C. Take-off Run
☐ D. Climb
☐ E. En Route
☐ F. Descent
☐ G. Approach
☐ H. Landing Roll

13. Part(s) of Aircraft Struck or Damaged

	Struck	Damaged		Struck	Damaged
A. Radome	☐	☐	H. Propeller	☐	☐
B. Windshield	☐	☐	I. Wing/Rotor	☐	☐
C. Nose	☐	☐	J. Fuselage	☐	☐
D. Engine No. 1	☐	☐	K. Landing Gear	☐	☐
E. Engine No. 2	☐	☐	L. Tail	☐	☐
F. Engine No. 3	☐	☐	M. Lights	☐	☐
G. Engine No. 4	☐	☐	N. Other:	☐	☐

(Specify, if "N. Other" is checked)

14. Effect on Flight
☐ None
☐ Aborted Take-Off
☐ Precautionary Landing
☐ Engines Shut Down
☐ Other: *(Specify)*

15. Sky Condition
☐ No Cloud
☐ Some Cloud
☐ Overcast

16. Precipitation
☐ Fog
☐ Rain
☐ Snow
☐ None

17. Bird/Other Wildlife Species

18. Number or birds seen and/or struck

Number of Birds	Seen	Struck
1	☐	☐
2-10	☐	☐
11-100	☐	☐
more than 100	☐	☐

19. Size of Bird(s)
☐ Small
☐ Medium
☐ Large

20. Pilot Warned of Birds ☐ Yes ☐ No

21. Remarks *(Describe damage, injuries and other pertinent information)*

DAMAGE / COST INFORMATION

22. Aircraft time out of service:
_____ hours

23. Estimated cost of repairs or replacement *(U.S. $)*:
$

24. Estimated other cost *(U.S. $) (e.g. loss of revenue, fuel, hotels)*:
$

Reported by *(Optional)*

Title

Date

Paperwork Reduction Act Statement: The information collected on this form is necessary to allow the Federal Aviation Administration to assess the magnitude and severity of the wildlife-aircraft strike problem in the U.S. The information is used in determining the best management practices for reducing the hazard to aviation safety caused by wildlife-aircraft strikes. We estimate that it will take approximately **5 minutes** to complete the form. If you wish to make any comments concerning the accuracy of this burden estimate and any suggestions for reducing this burden, send those comments to the Federal Aviation Administration, Management Staff, ARP-10, 800 Independence Avenue, SW, Washington, DC 20591. The information collected is voluntary. Please note that an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control number associated with this collection is 2120-0045.

FAA Form 5200-7 (3-97) Supersedes Previous Edition ☆ U.S. GPO: 1997-418-084/64203 NSN:0052-00-651-9005

U.S. Department
of Transportation

Federal Aviation Administration

800 Independence Ave., S.W.
Washington, D C 20591

Official Business
Penalty for Private Use, $300

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Federal Aviation Administration
Office of Airport Safety and Standards, AAS-310
800 Independence Avenue, SW
WASHINGTON, DC 20591

NO POSTAGE
NECESSARY
IF MAILED IN
THE UNITED
STATES

Directions for FAA Form 5200-7
Bird/Other Wildlife Strike Report

1. Name of Operator - This can be an airline (abbreviations okay - UAL, AAL, etc.), business (Coca Cola), government agency (Police Dept., FAA) or if a private pilot, his or her name.
2. Aircraft Make/Model - Abbreviations are okay, but try to include the model (e.g., B737-200).
3. Engine Make/Model - Abbreviations are allowed (e.g., PW 4060, GECT7, LYC 580).
4. Aircraft Registration - This means the N# (for USA registered aircraft).
5. Date of Incident - Give the local date, not the ZULU or GMT date.
6. Local Time of Incident - Check the appropriate light conditions and fill in the hour and minute local time and check AM or PM or use the 24 clock and skip AM/PM.
7. Airport Name - Use the airport name or 3 letter code if a US airport. If a foreign airport, use the full name or 3 letter code and location (city/country).
8. Runway used - Self explanatory.
9. Location if En Route - Put the name of the nearest city and state.
10. Height AGL - Put the feet above ground level at the time of the strike (if you don't know, use MSL and indicate this). For take-off run and landing roll, it must be 0.
11. Speed (IAS) - Speed at which the aircraft was traveling when the strike occurred.
12. Phase of Flight - Phase of flight during which the strike occurred. Take-off run and landing roll should both be 0 AGL.
13. Part(s) of Aircraft Struck or Damaged - Check which parts were struck and damaged. If a part was damaged but not struck, indicate this with a check on the damaged column only and indicate in comments (#21) why this happened (e.g., the landing gear might be damaged by deer strike, causing the aircraft to flip over and damage parts not struck by deer).
14. Effect on Flight - You can check more than one and if you check "Other", please explain in Comments (#21).
15. Sky Condition - Check the one that applies.
16. Precipitation - You may check more than one.
17. Bird/Other Wildlife Species - Try to be accurate. If you don't know, put unknown and some description. Collect feathers or remains for identification for damaging strikes.
18. Number of birds seen and/or struck - Check the box in the Seen column with the correct number if you saw the birds/other wildlife before the strike and check the box in the Struck column to show how many were hit. The exact number, can be written next to the box.
19. Size of Bird(s)- Check what you think is the correct size (e.g. sparrow = small, gulls = medium and geese = large).
20. Pilot Warned of Birds - Check the correct box (even if it was an ATIS warning or NOTAM).
21. Remarks - Be as specific as you can. Include information about the extent of the damage, injuries, anything you think would be helpful to know. (e.g., number of birds ingested).
22. Aircraft time out of service - Record how many hours the aircraft was out of service.
23. Estimated cost of repairs or replacement - This may not be known immediately, but the data can be sent at a later date or put down a contact name and number for this data.
24. Estimated other cost - Include loss of revenue, fuel, hotels, etc. (see directions for #23).
25. Reported by - Although this is optional, it is helpful if questions arise about the information on the form (a phone number could also be included).
26. Title - This can be Pilot, Tower, Airport Operations, Airline Operations, Flight Safety, etc.
27. Date - Date the form was filled out.

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APPENDIX I

GULL FACTS FOR AIRPORT WILDLIFE CONTROL PERSONNEL

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GULL FACTS FOR AIRPORT WILDLIFE CONTROL PERSONNEL

1. There are about 50 species of gulls in the world of which 15 are regularly found in North America.

2. Gulls are the most frequently reported birds struck by civil aircraft in the United States. From 1990-1998, about 30% of all identified bird strikes involved gulls.

3. The sexes are identical in plumage but males are generally slightly larger than females. For example, male laughing gulls weigh 10% more than females on average whereas male herring gulls weight 19% more than females.

4. Gulls are generally long-lived with annual survival rates of 70 to 90%. A number of banded herring gulls have been recovered after 20 years and the record is over 30 years. Gulls begin losing bands due to wear and corrosion after 10 to 15 years so we really do not know how long they may live in the wild.

5. Male and female gulls form pairs during the nesting season and both sexes contribute about equally to nest building, incubation, and feeding of chicks. Clutch size is usually 3 eggs and incubation takes about 20 (laughing gull) to 28 days (great black-backed gull). Young fledge 35 (laughing gull) to 50 days (great black-backed gull) later. Gulls will renest if nests are destroyed early in the nesting season.

6. Gulls attain adult body size within 6 to 8 weeks of hatching but do not obtain adult plumage and mature sexually until 2 years (for small gulls) to 4-5 years (for large gulls). Plumage is generally all brown in the summer-fall of hatching year. Plumage acquires more adult characteristics with each successive molt. Plumage of immature gulls can be quite variable. Species identification and age classification of immature gulls can sometimes be difficult.

Sources of information about gulls

Dunning, J. B. Jr., editor. 1993. CRC Handbook of Avian Body Masses. CRC Press, Boca Raton, Florida. 371 pages. (Body weights for birds throughout the world)

Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The Birder's Handbook. Simon and Schuster, New York. 785 pages. (Provides a wealth of conveniently summarized life history information on gulls and most other North American bird species)

Grant, P. J. 1986. Gulls: A Guide to Identification. Buteo Books, Vermilion, South Dakota. 352 pages. (Detailed plumage characteristics in all age classes)

FACT SHEET FOR COMMON GULL SPECIES IN NORTH AMERICA

Species	Mean body mass: pounds (grams)			Mean length: inches (centimeters)		Age (yr.) of first repro-duction
	Male	Both sexes	Female	Bill to tail	Wingspan	
Bonaparte's gull *Larus philadelphia*		0.5 (212)		11 (28)	32 (81)	2-3
Franklin's gull *Larus pipixcan*		0.6 (280)		11 (28)	35 (89)	2-3
Laughing gull *Larus atricilla*	0.8 (345)		0.7 (312)	13 (33)	41 (104)	2-3
Mew gull *Larus canus*	1.0 (432)		0.8 (375	14 (35)	42 (107)	3-4
Ring-billed gull *Larus delawarensis*	1.2 (566)		1.0 (471)	16 (41)	49 (124)	3-4
California gull *Larus californicus*	1.4 (657)		1.2 (556)	17 (43)	52 (132)	3-4
Herring gull *Larus argentatus*	2.7 (1226)		2.3 (1044)	20 (51)	55 (140)	3-5
Glaucous-winged gull *Larus glaucascens*		2.2 (1010)		22 (56)	54 (137)	3-5
Western gull *Larus occidentalis*		2.2 (1011)		21 (53)	55 (140)	3-5
Great black-backed gull *Larus marinus*	4.0 (1829)		3.3 (1488)	24 (61)	65 (165)	4-5

APPENDIX J

ASSESSING WILDLIFE HAZARD MANAGEMENT PLANS AT CIVIL AIRPORTS

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ASSESSING WILDLIFE HAZARD MANAGEMENT PLANS AT CIVIL AIRPORTS

This appendix describes a system (modified from Seubert 1994[1]) for objectively assessing the implementation of wildlife hazard management plans at civil airports. Five assessment categories, each with a list of elements to be evaluated, are used to indicate how well airport wildlife hazard management plans are being implemented.

Category 1. Management functions related to wildlife hazards at or in the vicinity of the airport.

Category 2. Bird control at or in the vicinity of the airport.

Category 3. Mammal control at or in the vicinity of the airport.

Category 4. Management of habitat and food sources on airport property related to wildlife hazards.

Category 5. Land uses and food sources off airport property potentially related to wildlife hazards at the airport.

The elements described in Categories 1-4 are assessed as to the degree that management programs are being implemented. The elements in Category 5 are rated as to the degree of hazard posed. Elements within each category are not intended to cover every possibility – they can be modified or expanded to meet situations unique to an airport.

During an assessment, each element in Categories 1-4 is examined and classified as one of the following:

S = Satisfactory. If an assessor finds that an airport has initiated action to reduce a wildlife hazard according to plan and is on schedule, the action would be considered **"satisfactory"**.

U = Unsatisfactory. If no measures have been taken or inappropriate measures taken, the assessment would be **"unsatisfactory".**

NI = Needs improvement. If implementation of a control measure is behind schedule or only partially accomplished, the assessment would be either **"needs improvement"**, or **"unsatisfactory"**, depending on the seriousness of the hazard.

[1] Seubert, J. L. 1994. Assessing the implementation of wildlife hazard management programs at civil airports. Proceedings Bird Strike Committee Europe 22:275-284.

NA = Not applicable. If it is apparent that certain listed techniques or items are not applicable to the airport, the assessment would be **"not applicable".**

If an assessment is either "**NI**" or "**U**", a comment by an assessor is required on the **Assessment Summary Form** (last page). Examples of assessments requiring comments are as follows:

Category 1. Management functions related to wildlife hazards at or in the vicinity of the airport.

If permits have not been obtained (Code 1.1) for shooting or trapping birds or mammals, the assessment would be "U".

If animal remains found on runways are being counted to document bird strikes, but are not being identified by species (Code 1.13), the assessment would be "NI".

Category 2. Bird control at or in the vicinity of the airport.

If bioacoustics are not being used (Code 2.2), the assessment would be "U".

If the installation of wires (Code 2.9) over an airport pond is behind schedule, the assessment could be "NI" or "U", depending on the degree of potential hazard.

If raptors are not being trapped and relocated (Code 2.22), the assessment would be "U".

Category 3. Mammal control at or in the vicinity of the airport.

If fencing (Code 3.2) is in need of repair, the assessment would be "NI".

If rodenticides (Code 3.12) are not being used to control a rodent population attracting raptors, the assessment would be "U".

Category 4. Airport habitat and food sources related to wildlife hazards.

If airport litter control is inadequate (Code 4.9), the assessment would be "NI".

If trees used as a roost site (Code 4.3) are not being eliminated or thinned to be made unattractive, the assessment would be "U".

Categories 1-4 focus on actions that can be taken on the airport to reduce wildlife hazards.

Category 5 provides a list of off-airport land uses and food sources that may be attractive to birds or other wildlife. The assessor should review this list and score each element on a scale of 0 to 3:

0 = land use or food source not present;

1 = present but no wildlife problems noted or anticipated;

2 = site attracts some hazardous wildlife creating possible or potential problem, site should be monitored;

3 = site creates significant wildlife hazard for airport, action should be taken.

Wildlife hazards at airports frequently are attributable to these off-site attractants, but airport managers have no authority over the use of private property. However, airport managers can initiate programs to reduce the hazards of these off-airport wildlife attractants (e.g., garbage dumps, certain agricultural activities) by informing local jurisdictions and landowners of the hazards, and suggesting ways of alleviating them (Code 1.12).

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Airport _____ Date_____ Assessment Page 1 of 6

CATEGORY 1. Management functions related to wildlife hazards at or in the vicinity of the airport.

CODE	ITEMS	ASSESSMENT			
		S	NI	U	NA
1.1	Acquiring wildlife control permits from federal, state, and local agencies				
1.2	Arranging for wildlife hazard assessments and other studies, as needed, to evaluate hazard potential of wildlife attracted by habitats, land uses, and food sources on or in vicinity of airport.				
1.3	Developing Wildlife Hazard Management Plan based on Wildlife Hazard Assessment and other studies and factors.				
1.4	Defining and delegating authority and responsibility for Wildlife Hazard Management Plan.				
1.5	Supervising, implementing, and coordinating airport Wildlife Hazard Management Plan.				
1.6	Evaluating Wildlife Hazard Management Plan at least once a year.				
1.7	Training personnel responsible for implementing airport Wildlife Hazard Management Plan, especially field personnel.				
1.8	Operating wildlife patrol system with a trained field staff , conducting surveillance/inspections of critical airport areas, and effecting wildlife control when needed or requested.				
1.9	Establishing a communication capability between wildlife control and ATC personnel.				
1.10	Maintaining a system for warning pilots about wildlife hazards (e.g., NOTAMS, ATC, Radar observations).				
1.11	Ensuring that airport habitats are managed to reduce or eliminate wildlife attractions.				
1.12	Ensuring that airport policy prohibits feeding of wildlife and exposure of food wastes.				
1.13	Interacting with local jurisdictions and landowners about zoning, land use, and the resolution of wildlife hazard problems in vicinity of airport.				
1.14	Maintaining log book with daily record of wildlife control activities, wildlife activity, and reported wildlife strikes and wildlife remains found on runways identified by species.				
1.15	Reporting all wildlife strikes to FAA.				

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Airport _____ Date_____ Assessment Page 2 of 6

CATEGORY 2. Bird control at or in the vicinity of the airport.

CODE	TECHNIQUES	ASSESSMENT			
		S	NI	U	NA
	DISPERSE, DETER, EXCLUDE, REPEL				
2.1	Bird patrols in vehicle				
2.2	Bioacoustics (distress calls)				
2.3	Electronically generated noise				
2.4	Propane cannons				
2.5	Pyrotechnics				
2.6	Shooting to scare				
2.7	Netting hangar rafters, ponds etc.				
2.8	Perching deterrents (e.g., stainless steel needles)				
2.9	Overhead wires for ponds, ditches, roofs etc.				
2.10	Chemical repellents				
2.11	Falconry				
2.12	Dogs				
2.13	Radio-controlled aircraft				
2.14	Thinning or eliminating roosting trees and shrubs				
2.15	Grass management				
2.16	Scarecrows				
2.17	Dead bird effigies				
	REMOVE				
2.18	Chemical capture (alpha chloralose)				
2.19	Nest and egg destruction				
2.20	Poisoning				
2.21	Predators to remove eggs (foxes, pigs, etc.)				
2.22	Shooting				
2.23	Trapping and relocation (e.g., raptors)				

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Airport _____ Date_____ Assessment Page 3 of 6

CATEGORY 3. Mammal control at or in the vicinity of the airport.

CODE	TECHNIQUES	ASSESSMENT S	NI	U	NA
	DISPERSE, DETER, EXCLUDE, REPEL				
3.1	Cattle guards				
3.2	Fencing				
3.3	Vehicle patrols				
3.4	Propane cannons				
3.5	Pyrotechnics				
3.6	Rodent-resistant sheathing on electrical cables				
	REMOVE				
3.7	Controlled hunting (e.g., deer)				
3.8	Den destruction (e.g., coyotes)				
3.9	Fumigants (e.g., woodchucks)				
3.10	Kill trapping (e.g., beavers, muskrats)				
3.11	Live trapping and relocation or euthanasia (e.g., dogs)				
3.12	Rodenticides (e.g., mice, ground squirrels)				
3.13	Shooting (e.g., deer, woodchucks, hares)				

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Airport_____ **Date**_____ **Assessment Page 4 of 6**

CATEGORY 4. Management of habitat and food sources on airport property related to wildlife hazards.

CODE	ITEMS	ASSESSMENT			
		S	NI	U	NA
	AGRICULTURE/VEGETATION MANAGEMENT				
4.1	Agricultural crops (especially grains)				
4.2	Plowing, mowing, harvesting (rodents, insects, worms)				
4.3	Landscaping (fruits & roost sites attractive to birds)				
4.4	Brush, shrubs, wood lots (cover, browse for deer)				
4.5	Misc. nesting sites (e.g., trees) for egrets, raptors, etc.				
	WASTE MANAGEMENT/SANITATION				
4.6	Feeding birds and mammals (by people)				
4.7	Food waste storage (e.g., cafeterias, catering services)				
4.8	Garbage dumps				
4.9	Litter				
4.10	Sewage treatment ponds/lagoons/outfalls				
4.11	Weeds, construction debris, junk yards				
4.12	Animal carcasses (dead livestock, bird strike remains)				
	WATER SOURCES				
4.13	Aquatic vegetation				
4.14	Canals, ditches, creeks, waterways				
4.15	Low areas on pavement/ground that collect water				
4.16	Retention ponds (water, de-icing fluid)				
4.17	Water fountains				
	MISCELLANEOUS ATTRACTANTS				
4.18	Earthworms along runways				
4.19	Insects hatches from vegetation or soil				
4.20	Seed-producing vegetation.				
4.21	Flat roofs (e.g., gull nesting and loafing sites)				
4.22	Structures (hangars, towers, signs, poles, etc.)				

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Airport_____ **Date**_____ **Assessment Page 5 of 6**

CATEGORY 5. Land uses and food sources off airport property potentially related to wildlife hazards at the airport.

CODE	ITEMS	Score[a]	COMMENTS
	Agriculture		
5.1	Agricultural crops (especially grains)		
5.2	Aquaculture facilities		
5.3	Livestock feedlots		
5.4	Grain storage or grain mills		
	Commercial/recreational land uses		
5.5	Drive-in theaters, amusement parks etc.		
5.6	Restaurants (esp. outdoor eating areas)		
5.7	Picnic areas, parks		
5.8	Marinas		
5.9	Golf courses		
5.10	Flat roofs (gull nesting sites)		
	Waste management		
5.11	Garbage barges		
5.12	Garbage dumps		
5.13	Garbage transfer stations		
5.14	Fish processing plants		
5.15	Sewage lagoons, outfalls		
	Water sources		
5.16	Retention ponds (water, feedlots, etc.)		
5.17	Canals, creeks, ditches		
5.18	Reservoirs, lakes, natural ponds		
	Nesting/loafing/feeding areas		
5.19	Wildlife refuges/nature preserves		
5.20	Misc. nesting sites (egrets, raptors, etc.)		
5.21	Roosting trees (starlings, egrets, etc.)		
5.22	Marshes, swamps, mud flats		

[a] **0** = not present; **1** = present but no wildlife problems noted or anticipated; **2** = site attracts some hazardous wildlife creating possible or potential problem, site should be monitored; **3** = site creates significant wildlife hazard for airport, action should be taken.

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Airport_____ **Date**_____ **Assessment Page 6 of 6**

SUMMARY FORM (Wildlife Hazard Assessment): Comments are required for all elements in Categories 1-4 assessed as "**Unsatisfactory**" or as "**Needs Improvement**" or with a score of 2 or 3 in Category 5.

Airport:	**Date**
Manager or wildlife supervisor:	**Phone:**
	Fax:
	E mail:
Assessor:	**Phone:**
	Fax:
	E mail:

Assessors comments for elements rated **"unsatisfactory"** or **"needs improvement"** in Categories 1-4 or for elements scored **2** or **3** in Category 5.

Element code	Assessment symbol	Comment

Assessor's general comments (use back if needed):

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APPENDIX K

AVIARY AND FIELD EVALUATIONS OF VARIOUS WILDLIFE CONTROL PRODUCTS AND STRATEGIES FOR AIRPORTS

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AVIARY AND FIELD EVALUATIONS OF VARIOUS WILDLIFE CONTROL PRODUCTS AND STRATEGIES FOR AIRPORTS

Richard A. Dolbeer, *USDA/APHIS/Wildlife Damage Control, National Wildlife Research Center, Ohio Field Station, 6100 Columbus Avenue, Sandusky, OH 44870*

Numerous products and strategies are available to reduce bird and other wildlife activity around airport buildings and runways. Many of these products and strategies are promoted and sold with only anecdotal evidence to support efficacy claims. Wildlife damage biologists frequently are asked for advice on the purported efficacy of these approaches. Too often, no data or insufficient data are available to make informed recommendations about a particular product. Thus, purchases are often made and products or strategies deployed that prove unsatisfactory. Not only do these purchases result in wasted money, but they may also increase hazards if airport personnel believe the deployment of an ineffective strategy has solved the problem.

Evaluation of these devices and strategies under controlled conditions with sufficient replications to provide statistically rigorous results is difficult, especially for birds. The Ohio Field Station (OFS) of the U.S. Department of Agriculture's National Wildlife Research Center (NWRC) is located on a 5,400-acre fenced site, Plum Brook Station [PBS], operated by the National Aeronautical and Space Administration, Erie County, Ohio. PBS provides an ideal outdoor laboratory for wildlife damage control tests. The site contains a 24-cage outdoor aviary and a 10-acre Canada goose pond and grass facility for tests with captive birds. PBS also has large populations of free-roaming deer, starlings and other wildlife. PBS is within 50 miles of several large gull colonies along the shore of Lake Erie where testing also can be done.

Through an interagency agreement with the Federal Aviation Administration (FAA), the OFS has evaluated over 30 wildlife control products and strategies since 1992. These tests provide objective data on the efficacy and limitations of various products and strategies—information that should be helpful to airport personnel and wildlife damage control biologists. Having said this, I emphasize that these tests typically do not provide a definitive, all-encompassing assessment of a product's value or limitations. Product efficacy may vary depending on wildlife species, time of year, context of presentation and other factors. However, the tests do provide objective data on performance under controlled or measured conditions so that at least some conclusions can be drawn regarding potential usefulness in an airport environment.

Below is a listing of publications with abstracts by species group that document the results of these tests. Copies of the full publications can be obtained from university libraries or by contacting the NWRC library at www.aphis.usda.gov/ws/nwrc. I acknowledge the creative test designs developed and work carried out by the various USDA employees listed in the publications. I also gratefully acknowledge the support provided by the FAA, especially S. Agrawal, M. Hovan, and T. Hupf (William J. Hughes Technical Center, Atlantic City, NJ) and E. C. Cleary (Office of Airport Safety and

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GULLS AND RELATED SPECIES

1. Belant, J. L. 1997. Gulls in urban environments: landscape-level management to reduce conflict. Landscape and Urban Planning 38:245-258. ***Abstract:*** Populations of several species of gulls (*Larus* spp.) have increased dramatically throughout coastal areas of North America and Europe during the past several decades. These increases have been attributed generally to protection from human disturbance, reduction in environmental contaminants, availability of anthropogenic food, and the ability of gulls to adapt to human-altered environments. Gull abundance in urban areas has resulted in numerous conflicts with people including hazards to aircraft, transmission of pathogens and parasites through contamination of water sources, damage to buildings from nesting material and defecation, and general nuisance. Various architectural and habitat management approaches presently are available to reduce gull/human conflicts. For example, gull use of putrescible-waste landfills may be reduced by covering refuse, diverting anthropogenic food to covered compost facilities, erecting wire grids over exposed refuse, and manipulation of turf height in loafing areas. Nesting on roofs can be alleviated through modifications of roofing substrate, reducing the number of roof structures present, and placement of overhead wires. Also, attractiveness of airports to gulls can be reduced through drainage of temporary water and by decreasing the availability of prey and loafing sites through habitat management. Architectural design and characteristics of adjacent habitat should be considered during the planning stages of new facilities in areas where use by gulls is likely. Although control activities can be effective at the site where the gull problem occurs, uncoordinated management efforts may cause relocation of problems to surrounding areas. Also, site-specific management will rarely solve the problem across a larger scale (e.g., city-wide). A working group comprised of the respective city or county planning commission, affected businesses and other government agencies, private citizens, and wildlife professionals can provide overall direction for gull management. This working group should define the extent and nature of the problem, develop an appropriate management strategy incorporating ecology of the nuisance species, and conduct periodic assessments of program efficacy. An integrated, landscape-level management approach is necessary to ensure an overall reduction in conflict between gulls and people in urban environments.

2. Belant, J. L. , S. W. Gabrey, R. A. Dolbeer, and T. W. Seamans. 1995. Methyl anthranilate formulations repel gulls and mallards from water. Crop Protection 14:171-175. ***Abstract:*** Two formulations of methyl anthranilate (MA), one (ReJeX-iT^{TM} TP-40 [TP-40]) containing a surfactant, the other (ReJeX-iT^{TM} AP-50 [AP-50]) a miscible, free-flowing powder, effectively repelled captive mallards from pools of water in a pen test and/or free-ranging ring-billed and herring gulls from pools of water at a landfill for 4 to 11 days. With one exception, pool entries and bill contacts with water

were reduced ($P \leq 0.02$) in pools treated with either formulation compared to untreated pools. Overall gull activity was reduced ($P \leq 0.01$) when all available water was treated with AP-50. Repellency of gulls and mallards from water was achieved with concentrations of MA (0.016-0.038%, v/v) 10-60 times lower than needed in previous studies to repel birds from food. These tests indicate that MA-based formulations in low concentrations should have utility in various agricultural and other situations where it is desirable to reduce bird activity in water.

3. Belant, J. L., and S. K. Ickes. 1996. Overhead wires reduce roof-nesting by ring-billed and herring gulls. Proceedings of the Vertebrate Pest Conference 17:108-112. ***Abstract:*** We evaluated the effectiveness of overhead wires in reducing roof-nesting by ring-billed gulls (*Larus delawarensis*) and herring gulls (*L. argentatus*) at a 7.2-ha food warehouse in northern Ohio during 1994-1995. In 1994, stainless steel wires (0.8 mm diameter) were attached generally in spoke-like configurations between 2.4 m upright metal poles spaced at 33.7-m intervals over the main portion of roof. The 6-14 wires radiating from each pole created a mean maximum spacing between wires of about 16 m. Nesting by ring-billed and herring gulls was reduced by 76% and 100% in 1994 and by 99% and 100% in 1995, respectively, compared to 1993 pretreatment levels (1,011 ring-billed gull nests and 98 herring gull nests). Ring-billed gulls that constructed nests after wire installation gained access to the roof where wires were not installed along the roof edge, where wires were broken, by hovering over wires and landing between them, or from structures such as air conditioners that were at or above the level of surrounding wires. Initial placement of overhead wires above roof structures and regular maintenance of broken wires is recommended to increase effectiveness. Mean maximum spacing of 16 m between wires was effective in excluding nesting by herring gulls; however, narrower spacing is necessary to exclude nesting by ring-billed gulls. Also, many of the ring-billed gulls displaced by wires from the warehouse in 1994 relocated to nest on an adjacent building without overhead wires. Thus, although overhead wires can be effective in reducing nesting by gulls on roofs and in other urban situations, management should be considered at a scale broader than specific problem sites as displacement of nesting gulls may cause relocation of the colonies to surrounding areas.

4. Belant, J. L., and S. K. Ickes. 1997. Mylar flags as gull deterrents. Proceedings of the Great Plains Wildlife Damage Control Conference 13:73-80. ***Abstract:*** During 1996, we evaluated the effectiveness of mylar flags for deterring herring gulls (*Larus argentatus*) from 2 nesting colonies (roof and breakwall) and herring and ring-billed *(L. delawarensis*) gulls from 2 loafing sites at a landfill. Mylar flags (15 cm x 1.0 m) attached to wire or lathe supports were positioned at 6-m intervals at nesting colonies and 3- to 12-m intervals at loafing areas. For both nesting colonies, time of nest initiation, nest density, and clutch size in 1996 when flags were present was similar to or greater than values obtained for these parameters at the same colonies in 1995 when flags were not present. The maximum number of chicks observed at the roof colony in 1996 was also similar to the maximum number of chicks observed in 1995. At the landfill, we observed fewer gulls ($P < 0.05$) at 1 loafing site

during the 2 weeks when mylar flags (6- and 12-m spacing) were present than during the 2 weeks when flags were not present. In contrast, gull use of the second loafing area did not appear influenced by the presence of mylar flags (3- and 6-m spacing), likely because of its small size (6 x 90 m) and proximity to a frequently used pond. We conclude that mylar flags are ineffective in deterring herring gulls (and likely other gulls) from nesting colonies but can reduce gull use of loafing areas.

5. Blackwell, B. F., T. W. Seamans, D. A. Helon, and R. A. Dolbeer. 1999. Early loss of herring gull clutches after egg-oiling. Wildlife Society Bulletin: In Press. ***Abstract*****:** Critical to the success of egg-oiling as a means to control growth of bird populations is extension of the incubation period, thereby minimizing renesting attempts. Egg-oiling studies conducted with ring-billed (*Larus delawarensis*) and herring (*L. argentatus*) gulls generally have reported no evidence of abandonment of oiled clutches up to the expected hatching date (EHD). However, comparisons of clutch loss (assumed primarily to predation) up to EHD among control and treatment groups were not reported. Therefore, we evaluated early (oiling 21-27 days before EHD) and late (oiling 7-15 days before EHD) oiling protocols in a herring gull colony on Lake Erie, Erie County, Ohio. Marked differences ($P < 0.01$) were observed among treatments in the number of nests producing chicks (90.0%, $n = 100$, control; 20%, $n = 100$, early oil, and 1%, $n = 100$, late oil). Clutches in nests assigned to the 2 oil groups were more frequently ($P < 0.01$) lost (6% control; 29% early; 38% late) to abandonment, storms, and predation up to EHD. Only 56% of oiled clutches were incubated past EHD. Clutch loss (including nest abandonment) up to EHD did not differ ($P = 0.35$) between nests in the early and late oil groups. Our data suggest that herring gulls were sensitive to oil and that nests were abandoned or clutches lost within the normal incubation period in numbers greater than expected under natural conditions. The effectiveness of egg-oiling in reducing recruitment in herring gull colonies is improved by oiling nests late in the incubation period. Subsequent oil applications will allow for inclusion of late nests and renesting attempts.

6. Dolbeer, R. A. 1998. Evaluation of shooting and falconry to reduce bird strikes with aircraft at John F. Kennedy International Airport. Proceedings of the International Bird Strike Committee 24:145-158. ***Abstract:*** The collision of birds with aircraft is a serious problem at John F. Kennedy International Airport (JFKIA), New York. Gulls (*Larus* spp.), primarily laughing gulls (*L. articilla*), accounted for 84% of bird strikes (an aircraft striking $\geq$1 bird) from 1988-1990, averaging 260 strikes/year. Laughing gulls are present from May-September in association with a nesting colony (7,629 nests, 1990; 3,381 nests, 1997) in Jamaica Bay adjacent to JFKIA. A program to reduce gull strikes was undertaken from May-August 1991-1997 in which 2-5 people stationed on airport boundaries shot gulls flying over the airport. In 6,369 person-hours of shooting, 52,235 gulls were killed, comprised of 47,601 laughing gulls and 4,634 other gulls. In 1996 and 1997, experimental falconry programs were implemented to complement the shooting program. In 1996, the falconry and shooting programs were conducted simultaneously from 21 June-9 August, after which shooting stopped but falconry continued until 20 October. In 1997, falconry began 25 July (1 week before

shooting program ended) and ended 25 November. A statistical comparison of mean strike rates for all birds and for gulls only during 1988-1990 (no shooting or falconry), 1991-1995 (shooting but no falconry) and 1996-1997 (shooting and falconry) indicated shooting reduced ($P < 0.01$) strikes but that falconry did not ($P \geq 0.24$). On a positive note, fewer gulls were shot and struck in 1996-1997 compared to 1994-1995 although the reductions were not statistically significant ($P > 0.05$). Falconry, which provides positive publicity and other unique attributes, can have a role in the integrated bird management program at JFKIA. However, additional years of data are needed to obtain a more definitive assessment of the role that falconry can play in reducing strikes. The falconry program will continue at JFKIA in 1998-2000 which should provide sufficient data for this more complete assessment.

7. Dolbeer, R. A. 1998. Keynote Address: Population dynamics: the foundation of wildlife damage management for the 21st century. Proceedings of the Vertebrate Pest Conference 18:2-11. ***Abstract***: To justify and defend lethal or reproductive control programs to solve vertebrate pest problems, wildlife biologists must have a sound understanding of the population status and dynamics of the problem species. Models are essential to project how populations will respond to proposed management actions, providing a scientific foundation to counter the emotional debates that often arise. Four population models (PM1-PM4) for predicting population responses are described. PM1 and PM2 explore the relative efficacy of reproductive and lethal control for vertebrate species over 10-year intervals. PM3 simulates population responses to actual management actions through 10-year intervals. PM4 simulates population changes for a species at weekly intervals over an annual cycle, exploring the immediate ($\leq$1 year) impact of population management actions. Population simulations using PM1 and PM2 demonstrated that for most vertebrate pest species considered, lethal control will be more efficient than reproductive control in reducing population levels. Reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates. A simulation (PM3) of the removal of 47,000 laughing gulls (*Larus atricilla*) from the Long Island-New Jersey population accurately predicted the 33% decline of the population over 5 years. A simulation (PM4) of the annual cycle of the common grackle (*Quiscalus quiscula*) population in the eastern United States demonstrated why removing 4.2 million birds in 1 winter had no discernible impact on subsequent breeding populations. Understanding the population dynamics of wildlife species is the cornerstone to successful management, and population models will be essential for this task in the years to come.

8. Dolbeer, R. A., D. P. Arrington, E. LeBoeuf, and C. Atkins. 1996. Can albatrosses and aircraft coexist on Midway Atoll? Bird Strike Committee Europe 23:327-335. ***Abstract:*** Aircraft collisions with birds (bird strikes), especially Laysan albatrosses (*Diomedea immutabilis*), have been a problem at Midway Naval Air Facility since at least the 1950s. Although aircraft movements at Midway presently are reduced relative to 1950-1970 levels, the U.S. Navy in 1993 still reported 57 strikes during 459 aircraft movements. We visited Midway from 15-21 April 1995 to determine

the species composition and diurnal pattern of bird flights over Runway 6-24 so that recommendations could be made regarding timing of aircraft movements to minimize strikes. Midway Atoll in 1994-1995 had an estimated 450,000 nesting pairs of albatrosses (900,000 adults), a mean density of 725 nests/ha. We recorded a mean of 363 birds (89% Laysan albatrosses) crossing the runway/minute during daylight hours. At night (2230-2300), we estimated only 5.7 birds/minute (89% Bonin petrels [*Pterodroma hypoleuca*]) flying over the runway, a 98.5% reduction over mean numbers during daylight. As Midway Atoll goes through the transition from military base to wildlife refuge, nonemergency aircraft movements should be restricted to night from November-mid July. Furthermore, any plans to develop "ecotourism" or other activities for the Atoll will need to factor in this constraint for aircraft movements. Under present conditions, daytime aircraft movements for commercial or private carriers would raise serious safety and liability issues.

9. Dolbeer, R. A., J. L. Belant, and J. Sillings. 1993. Shooting gulls reduces strikes with aircraft at John F. Kennedy International Airport. Wildlife Society Bulletin 21:442-450. ***Abstract:*** The collision of birds with aircraft is a serious problem at John F. Kennedy International Airport (JFKIA), New York City. Laughing gulls comprised 47% of the birds colliding with aircraft from 1988 to 1990, averaging 170 bird strikes per year. This species is present from May to September in association with a 7,600-nest colony (1990) adjacent to the airport. Other gulls (herring, great black-backed, and ring-billed), which are present year-round, comprised 37% of the strikes and another 52 species of birds comprised the remaining 16%. The airport has an active bird management program involving habitat alteration and the use of bird-frightening techniques to discourage birds from feeding, drinking, and loafing on airport grounds. However, these measures do little to prevent laughing gulls and other gull species from flying over the airport to non-airport feeding sites. An experimental program to reduce gull collisions with aircraft was undertaken in 1991 and 1992 in which 2 to 5 people stationed on airport boundaries used shotguns to shoot gulls flying over the airport from mid-May to early August. There were high levels of gull activity at JFKIA in the summers of 1991 and 1992, as evidenced by the ability of shooters to kill 26,038 laughing gulls and 2,314 other gulls flying over the airport in 2,206 person-hours of shooting. Shooting did not appear to condition gulls to avoid flying over the airport. The shooting program at JFKIA substantially reduced the incidences of strikes between all species of gulls and aircraft, by 70% in 1991 and 89% in 1992. The laughing gull nesting colony in its present location presents an unacceptable safety hazard to aircraft. The annual killing of large numbers of laughing gulls on the airport, while effective in reducing strikes, may not be effective in eliminating the colony from its present location. Discussions should continue with NPS personnel to develop a plan to relocate the colony from Jamaica Bay. This plan could include habitat alteration, nest destruction, and other harassment and management techniques at the colony. However, a seasonal shooting program should continue on the airport to minimize the number of gull-aircraft collisions until the laughing gull colony is relocated from Jamaica Bay.

10. Dolbeer, R. A., and J. L. Bucknall. 1994. Shooting gulls reduces strikes with aircraft at John F. Kennedy International Airport, 1991-1993. Bird Strike Committee Europe 22:375-396. ***Abstract:*** The collision of birds with aircraft is a serious problem at John F. Kennedy International Airport (JFKIA), New York. Laughing gulls (*Larus articilla*) comprised 47% of the birds colliding with aircraft from 1988 to 1990, averaging 180 bird strikes per year. This species is present from May to September in association with a 7,600-nest colony (1990) adjacent to the airport. An experimental program to reduce gull collisions with aircraft was undertaken in 1991-1993 in which 2-5 people stationed on airport boundaries used shotguns to shoot gulls flying over the airport from May to August. IN 3,401 person-hours of shooting, 35,692 gulls were killed (13,866 in 1991, 13,466 in 1992 and 7.340 in 1993) comprised of 32,534 laughing gulls and 3,158 other gulls. The number of laughing gulls struck by aircraft during the shooting period (20 May-15 Aug) was the same time period for 1988-90. Strikes by the other gull species were reduced by a comparable amount. In spite of the removal of 32,000 laughing gulls in 1991-1993 (over twice the number of adults in the Jamaica Bay colony in 1990), the nesting colony declined by only about 20% from 1990 to 1993. Thus, although shooting is an effective means of reducing the incidence of bird strikes, the program has not significantly reduced the nearby nesting colony. Our recommended long-term solution is to relocate the nesting colony away from JFKIA. A seasonal shooting program should continue to minimize the number of gull-aircraft collisions until this relocation is achieved.

11. Ickes, S. I., J. L. Belant, and R. A. Dolbeer. 1998. Nest disturbance techniques to control nesting by gulls. Wildlife Society Bulletin 26:269-273. ***Abstract:*** Urban-nesting gulls throughout the lower Great Lakes often conflict with human activities. We evaluated 5 nest disturbance techniques (nest-and-egg removal, egg removal, nest-and-egg destruction, egg destruction, and egg replacement) to reduce herring gull (*Larus argentatus*) and ring-billed gull (*L. delawarensis*) nesting in urban habitat, primarily roofs, in northern Ohio. Nest disturbance techniques were more effective in causing colony abandonment for ring-billed gulls than for herring gulls. Nest disturbance conducted for 1 year at an established ring-billed gull colony, and for <1 week at a newly established ring-billed gull colony caused abandonment. Nest disturbance conducted for 1 to 10 years did not cause herring gulls to abandon 5 of 6 established colonies; however, reductions were observed in annual maximum number of nests or eggs. Egg removal was at least as effective as nest-and-egg removal and required about 60% less effort. Egg replacement was the least effective of the techniques evaluated. Unless structural damage to buildings is of concern, egg removal is recommended over other nest disturbance techniques evaluated for inexpensive, long-term reductions of roof-nesting colonies. Nest-and-egg or egg destruction is recommended for ground-nesting colonies. Use of other control methods (e.g., habitat modification, frightening techniques) in addition to nest disturbance may increase the potential for colony abandonment.

12. Seamans, T. W., and J. L. Belant. 1999. Comparison of DRC-1339 and alpha-chloralose for reducing herring gull populations. Wildlife Society Bulletin 27:In Press. ***Abstract*:** Results of several herring gull (*Larus argentatus*) control programs using DRC-1339 (3-chloro-4-methyl-benzenamine hydrochloride) suggested that the published median lethal dose (LD_{50}) of 2.9 mg of DRC-1339/kg of body weight may not be accurate in some environments. We conducted laboratory trials to estimate LD_{50} values of DRC-1339 and of alpha-chloralose (AC) for herring gulls inhabiting fresh water. We also conducted field trials to compare effectiveness of these compounds in simulated gull control operations. We calculated the LD_{50} for DRC-1339 as 4.6 mg/kg and 43.1 mg/kg for AC. Mean (± SD) time to death for DRC-1339-dosed birds varied from 34.0 (± 12.2) hours at LD_{96} to 109.5 (± 55.5) hours at LD_{27}. AC time to death varied from 2.3 (± 0.5) hours at >LD_{99} to 5.8 (± 0.0) hours at LD_{13}. In field trials, DRC-1339 baits treated at 27.4 mg/kg (LD_{99}) resulted in 29% known mortality. In contrast, AC baits with a 30 mg/kg dosage (<LD_{01}) resulted in 50% capture success and no mortality. AC baits at 58 mg/kg (LD_{99}) resulted in 89% capture success and 41% mortality. With AC baits at 95 mg/kg (> LD_{99}), 65% of gulls were captured with 82% mortality. AC was more effective than DRC–1339 in removing gulls from a nesting colony. We recommend AC as a gull population management chemical because it is fast acting, humane, and can be used as a nonlethal capture agent.

BLACKBIRDS AND STARLINGS

13. Belant, J. L., S. K. Ickes, L. A. Tyson, and T. W. Seamans. 1997. Comparison of d-pulegone and mangone as cowbird feeding repellents. International Journal of Pest Management 43:303-305. ***Abstract:*** We compared the effectiveness of d-pulegone and mangone as feeding repellents to captive adult male brown-headed cowbirds (*Molothrus ater*) during October-November 1995. For each repellent, we conducted 4-day, 1- and 2-choice cage tests using concentrations (g/g) of 0.1%, 0.01%, and 0.001% with millet. During 1- and 2-choice tests, 0.1% d-pulegone reduced ($P < 0.01$) cowbird feeding but lower concentrations did not. In contrast, concentrations of mangone as low as 0.001% reduced ($P < 0.05$) food consumption during 2-choice tests. Consumption of mangone-treated millet, however, was similar ($P > 0.05$) among 1-choice tests and similar to total food consumption observed during 2-choice tests. We conclude that mangone is less effective than d-pulegone and would likely be ineffective as a repellent for seed treatment. We recommend field tests to further assess the effectiveness of d-pulegone as an avian feeding repellent.

14. Belant, J. L., P. P. Woronecki, R. A. Dolbeer, and T. W. Seamans. 1998. Ineffectiveness of five commercial deterrents for nesting starlings. Wildlife Society Bulletin 26:264-268. ***Abstract:*** We evaluated the effectiveness of phenethyl alcohol (PEA), eyespots, magnetic fields, and avian-predator effigies to deter European starlings (*Sturnus vulgaris*) from nesting in artificial cavities in Ohio during 1993, 1995, and 1996. Each year, 81 nest boxes attached to utility poles were assigned at random equally among 3 treatments (including control): 1993 - PEA or eyespots, 1995 -

magnetic fields of 88 or 118 Gauss, and 1996 - great horned owl or merlin effigy. Starlings nested in 84% (1993), 58% (1995), and 90% (1996) of the boxes. There was no difference ($P \geq 0.13$) among treatments each year in 6-7 measures of starling nesting activity. Four species other than starlings (eastern bluebirds [*Sialia sialis*], house wrens [*Troglodytes aedon*], tree swallows [*Tachycineta bicolor*], and house sparrows [*Passer domesticus*]) occupied 13 (1993), 23 (1995), and 2 (1996) nest boxes. We conclude that PEA, eyespots, magnetic fields ≤118 Gauss, and avian-predator effigies are ineffective as deterrents for starlings nesting in artificial cavities.

15. Clark, L., and J. L. Belant. 1998. Contribution of particulates and pH on cowbirds' avoidance of food treated with agricultural lime. Applied Animal Behavior Science 57:133-144. ***Abstract:*** Agricultural lime used as a grain coating can be repellent to graniverous birds. However, whether repellency is achieved depends upon the method of preparation. The primary mechanism for mediating repellency is pH. Cowbirds avoid seed coated with agricultural lime (5% wt/wt) when the pH exceeds 12.3. A second underlying component mediating repellency exits that is based on avoidance of particulates. If the particulate seed coating consists of particles sized ~63-150 um, and has a pH of 11.4 or less, the repellent potency is about half that observed for raw unprocessed lime. Together, these data help explain emerging conflicting reports on the efficacy of agricultural lime as a bird-repellent. Finally, short-term data on food and water intake and energy balance suggest that periodic intake of agricultural lime does not adversely affect birds.

16. Dolbeer, R. A., and S. K. Ickes. 1994. Red-winged blackbird feeding preferences and response to wild rice treated with portland cement or plaster. Proceedings of the Vertebrate Pest Conference 16:279-282. ***Abstract:*** The California wild rice (*Zizania aquatica*) industry considers red-winged blackbirds (*Agelaius phoeniceus*) their most important pest problem. Farmers often have asked if crop-damaging blackbirds can be killed by mixing dry Portland cement or plaster-of-Paris with grain bait. We conducted a series of tests to determine the effect of cement or plaster mixed with wild rice fed to captive redwings and to determine feeding preferences of redwings for wild rice in relation to other grains. Birds would not eat cement- or plaster-treated rice when untreated rice was available and no mortality occurred when birds were offered only treated rice over a 4-day period. Thus, treating grain with cement or plaster will not kill redwings, but cement or plaster might serve as useful bird repellents for seed grain. Proso millet was strongly preferred over wild rice by redwings, indicating millet would be an excellent candidate as a lure crop and as a bait for trapping or for delivering a chemical. Sunflower would perhaps not be preferred bait or lure crop in wild rice areas and cracked corn would not be preferred bait.

17. Dolbeer, R. A., D. F. Mott, and J. L. Belant. 1997. Blackbirds and starlings killed at winter roosts from PA-14 applications: implications for regional population management. Proceedings of the Eastern Wildlife Damage Management Conference 7:77-86. ***Abstract***: The surfactant PA-14, registered with the U.S. Environmental Protection Agency in 1973 by the federal Wildlife Services

(WS) program, was used for 19 years (1974-1992) for lethal control of roosting blackbirds (Icterinae) and European starlings (*Sturnus vulgaris*) in the USA. In 1992, the WS program withdrew the registration of PA-14 because of costs required to provide additional EPA-requested data. There were 83 roosts encompassing 178 ha treated with 33,300 L of PA-14 from 1974-1992. An estimated 38.2 million birds (48% common grackles [*Quiscalus quiscula*], 30% European starlings, 13% red-winged blackbirds [*Agelaius phoeniceus*], and 9% brown-headed cowbirds [*Molothrus ater*]) were killed, an average of 2.0 million/year. The annual kill represented $\leq$1.3% of the national winter population of blackbirds and starlings. We found no evidence using North American Breeding Bird Survey (BBS) data that PA-14 applications caused declines in regional breeding populations. Furthermore, there was no evidence of secondary poisoning or other adverse environmental effects from PA-14 applications. If regional population management of blackbirds and starlings is to be implemented to reduce agricultural damage or conflicts with native songbirds, new approaches, such as reproductive control, are needed because PA-14 alone will not be adequate. However, PA-14 could have a role in such regional programs in addition to solving localized roost problems. PA-14 was a useful management tool safely applied in human-populated areas (where most roost problems occur); its reregistration should be considered as part of an integrated management program for blackbirds and starlings.

GEESE AND MISCELLANEOUS BIRDS

18. Belant, J. L., S. K. Ickes, L. A. Tyson, and T. W. Seamans. 1997. Comparison of four particulate substances as wildlife feeding repellents. Crop Protection 16:439-447. Abstract We compared the effectiveness of dolomitic lime, activated charcoal, Nutra-lite (a silica-based compound), and white quartz sand as feeding repellents for brown-headed cowbirds (*Molothrus ater*), white-tailed deer (*Odocoileus virginianus*), and Canada geese (*Branta canadensis*). In 4 day, 2-choice aviary tests with cowbirds, consumption of treated millet (1% to 4% g/g) was less ($P < 0.01$) than consumption of untreated millet for all particulates except Nutra-lite at 1% g/g. Greatest reductions in consumption occurred with lime-treated millet, followed by charcoal, Nutra-lite, and sand. Overall mean daily consumption of treated millet by cowbirds in 1-choice tests was similar ($P > 0.05$) to total consumption of millet in comparable 2-choice tests for each particulate. However, millet treated with 4% lime reduced cowbird consumption for 1 day. Similarly, in 4-day, 2-choice tests field tests involving free-ranging deer, deer consumed less corn treated (4% g/g) with lime or charcoal than corn treated with Nutra-lite or sand. Corn treated with sand did not reduce ($P = 0.44$) consumption by deer relative to untreated corn. Lime applied to turf in 10- x 21-m enclosures at an application rate of 270 kg/ha did not suppress grazing by geese. Nutra-lite applied to turf at the manufacturer-recommended rate of 2,568 kg/ha reduced overall goose presence on treated plots in enclosures for 3 days but suppressed goose grazing for 1 day only. We conclude that lime is more effective overall as a white-tailed deer and brown-headed cowbird feeding repellent than is charcoal, Nutra-lite, or sand. Lime has considerable potential as a feeding repellent in

agricultural and possibly turf situations. Charcoal could be used effectively in situations where lime is impractical.

19. Belant, J. L., T. W. Seamans, R. A. Dolbeer, and P. P. Woronecki. 1997. Evaluation of methyl anthranilate as a woodpecker repellent. International Journal of Pest Management 43:59-62. ***Abstract:*** We evaluated the effectiveness of ReJeX-iT^{TM} TP-40 (hereafter TP-40), containing 40% methyl anthranilate (MA) for deterring woodpeckers from food and from damaging wood siding. During December 1993-February 1994 we conducted three 2-week trials at four sites using six pairs of feeders containing untreated or TP-40-treated suet (5.0, 2.5, or 1.25% g/g). We then placed 10 (1995) and four (1996) pairs (1 each TP-40-treated and control) of boxes with wood siding containing untreated suet at seven and four sites with known woodpecker activity for 2-3 weeks to assess damage to the siding. We also applied TP-40 to woodpecker-damaged wood siding of 14 residential buildings during 1994-1996. Suet-eating birds, primarily downy woodpeckers (*Picoides pubescens*), were repelled ($P < 0.01$) by treated suet at all concentrations compared with untreated suet. In contrast, damage (primarily by downy woodpeckers) to wood siding on untreated and TP-40-treated boxes was similar ($P \geq 0.32$) in both years. Also, 5 of 10 buildings treated with TP-40 received woodpecker damage in areas treated previously. We conclude that TP-40 deters woodpecker from food but does not reduce woodpecker damage to wood siding. This difference in repellency is likely a consequence of rapid degradation of TP-40 from siding (49% in 3 days) and that woodpeckers do not ingest wood, which minimized their exposure to TP-40. We conclude that chemical repellents will generally be ineffective in reducing woodpecker damage to wood and that other techniques, including exclusion, frightening devices, and alternate forms of wood siding (e.g., wood composites) should be developed.

20. Belant, J. L., T. W. Seamans, L. A. Tyson, and S. K. Ickes. 1996. Repellency of methyl anthranilate to pre-exposed and naive Canada geese. Journal Wildlife Management 60:923-928. ***Abstract:*** To improve our understanding of the effectiveness of avian feeding repellents, we evaluated whether Canada geese (*Branta canadensis*) exhibited learned avoidance of ReJeX-iT AG-36 (AG-36), a methyl anthranilate (MA) formulation containing 14.5% MA (vol/vol). During 2 experiments in August-September 1995, we pre-exposed geese orally to 0.0, 1.3, or 4.0 g AG-36 and released them onto 10- x 10-m grass plots treated with AG-36 at rates of 22.6 and 67.8 kg/ha. Mean numbers of bill contacts and mean numbers of geese observed on control and treated plots were similar ($P \geq 0.21$) for geese pre-exposed or naive to AG-36. Overall, mean numbers of bill contacts and mean numbers of geese also were similar ($P \geq 0.56$) on control and treated plots. Mean mass of droppings on control and treated plots was similar ($P > 0.99$) during the experiment with 22.6 kg/ha AG-36 but was greater ($P = 0.01$) on control plots during the experiment with 67.8 kg/ha AG-36. We conclude that learned avoidance of AG-36 by Canada geese pre-exposed orally to 1.3 or 4.6 g AG-36 did not occur and that AG-36 applied to turf in enclosures at rates of 22.6 and 67.8 kg/ha was not effective as a grazing repellent for geese.

21. Belant, J. L., L. A. Tyson, T. W. Seamans, and S. K. Ickes. 1997. Evaluation of lime as an avian feeding repellent. Journal of Wildlife Management 61:917-924. ***Abstract:*** We evaluated the effectiveness of dolomitic hydrated lime as a feeding deterrent to captive brown-headed cowbirds (*Molothrus ater*) and Canada geese (*Branta canadensis*) during July-September 1995. We conducted 1- and 2-choice tests using grains with caged cowbirds and geese, and applications of lime to turf in dry and slurry form for geese. Lime mixed with millet or whole-kernel corn at 25, 12.5, and 6.25% (g/g) reduced cowbird and goose feeding in 4 day, 2-choice (treated or untreated grain) cage trials. Reductions in total food intake occurred for both species during similar 1-choice tests with lime (25% [g/g]) and millet or corn. Body mass of cowbirds and geese increased or remained constant during 2-choice tests. In contrast, body mass declined for both species during 1-choice tests. Application of lime to enclosed 10- x 10-m-grass plots in powder or slurry form at an application rate of 544 kg/ha also reduced goose feeding on treated plots for 2-3 days. Mean numbers of geese and mean fecal mass on control and treated plots were similar during both turf experiments. No phytotoxicity of grass was observed $\geq$40 days posttreatment. We recommend additional studies to determine the lower limit of repellency of lime to various bird species and its utility for turf and crop damage reduction.

22. Belant, J. L., and T. W. Seamans. 1999. Alpha-chloralose immobilization of rock doves in Ohio. Journal of Wildlife Diseases 35:239-242. ***Abstract*:** The effectiveness of 3 dosages (about 60, 120 and 180 mg/kg) of alpha-chloralose (AC) were compared for immobilizing pigeons (*Columba livia*). Responses to immobilization using about 180 mg/kg AC also was compared in pigeons food deprived for 24 hr and not food deprived. Mean ($\pm$ SE) time to first effects (33 $\pm$ 2 min) and mean time to capture (94 $\pm$ 5 min) was significantly less for pigeons receiving 180 mg/kg than for pigeons receiving lower dosages ($\geq$53 $\pm$ 3 min and $\geq$153 $\pm$ 17 min, respectively). Ten, 10 and 8 pigeons immobilized with 60, 120 and 180 mg/kg AC recovered within 24 hr, respectively; all pigeons recovered within 29 hours. Although food-deprived pigeons showed effects of AC immobilization earlier than did pigeons with food, time to capture was similar between these 2 groups. This new formulation should improve capture success of pigeons substantially and improve the ability to resolve nuisance pigeon problems.

23. Blackwell, B. F., T. W. Seamans, and R. A. Dolbeer. 1999. Plant growth regulator enhances repellency of anthraquinone formulation to Canada geese. Journal of Wildlife Management 63:1336-1343. ***Abstract:*** There is a need for nonlethal methods of reducing conflicts between burgeoning populations of resident Canada geese (*Branta canadensis*) and humans at airports and other settings. An anthraquinone-based formulation (Flight Control^{TM} [FC], 50% anthraquinone [AQ], active ingredient) has shown promise in deterring grazing by Canada geese. We hypothesized that the addition of a plant growth regulator (Stronghold^{TM} [SH]) might enhance the effectiveness of FC by minimizing the exposure of new, untreated grass. To isolate the effects of grass height, plant growth regulator, and the combination of a repellent with a plant growth regulator on grazing by geese, we conducted 3

experiments, each using 24 geese in 6 18 x 31-m pens, in northern Ohio during 1998. We evaluated the response of geese to short (4-11 cm) and tall grass (16-21 cm) in a 9-day test. Next, SH (applied at 1.2 L/ha) was evaluated as a grazing repellent in a 14-day test. Finally, we evaluated the effectiveness of FC (2.3 L/ha), combined with SH (0.9 L/ha SH), as a grazing repellent in a 22-day test. We found no difference (P = 0.53) in the number of geese per observation in tall- (1.7 ± 1.5; $\bar{x}$ ± SE) and short-grass plots (2.3 ± 1.5), nor in bill contacts per minute (P = 0.78) in tall- (12.6 ± 9.3) versus short-grass plots (11.1 ± 7.9). In the SH test, 14 days postapplication, mean grass height was 12.9 cm in untreated plots and 7.2 cm in treated plots. However, the number of geese per observation on untreated (1.8 ± 1.3) and treated plots (2.2 ± 1.3) did not differ (P = 0.57). Also, there was no difference (P = 0.71) in the number of bill contacts per minute in untreated (15.3 ± 9.9) and treated plots (18.1 ± 14.2). In contrast, over a 22-day FC/SH test, the mean number of geese per observation was 2.6 times greater (P < 0.01) on untreated (2.9 ± 0.5) than on treated plots (1.1 ± 0.5). Further, the mean number of bill contacts per minute was 8.2 times greater (P < 0.01) on untreated (54.4 ± 11.2) than treated plots (6.6 ± 2.3). We observed no abatement in repellency 22 days posttreatment. Thus, we conclude that SH greatly enhanced the repellency of FC to grazing Canada geese. The use of a plant growth regulator with FC should reduce goose foraging on turf.

24. Dolbeer, R. A., J. L. Belant, and L. Clark. 1993. Methyl anthranilate formulations to repel birds from water at airports and food at landfills. Proceedings of the Great Plains Wildlife Damage Control Conference 11:42-53. ***Abstract:*** We conducted 2 sets of experiments to evaluate methyl anthranilate (MA) as an avian repellent. The first set (May-Aug 1991) evaluated 2 Rejex-It™ formulations of MA applied to water at John F. Kennedy International Airport (JFKIA), New York. Our second set of experiments (Aug-Sep 1992) tested the hypothesis that MA mixed with a landfill cover material (ConCover 180$^{R)}$ would reduce consumption by birds when applied to food in a controlled environment (captive birds in cages). At JFKIA, fewer birds were seen in treated standing water than in untreated water, which supported results obtained in previous cage trials. In the landfill cover experiments, MA was repellent to cowbirds and ring-billed gulls at food sources, although a higher concentration (0.5% MA) was required to repel ring-billed gulls than cowbirds (0.15% MA). Cowbirds were repelled by similar concentrations of MA during tests using millet mixed with ConCover 180^{R}. MA appears promising as a bird repellent when applied to standing water and may help deter birds from feeding in landfills when incorporated into a landfill cover material such as ConCover.

25. Dolbeer, R. A., T. W. Seamans, B. F. Blackwell, and J. L. Belant. 1998. Anthraquinone formulation (Flight Control) shows promise as avian feeding repellent. Journal of Wildlife Management 62:1557-1563. ***Abstract:*** We evaluated the effectiveness of Flight Control™ [FC] (50% anthraquinone [AQ]) as a grazing repellent for Canada geese (*Branta canadensis*) and as a seed-treatment repellent for brown-headed cowbirds (*Molothrus ater*) in northern Ohio in 1997. For the turf test, FC was applied at 4.5 L/ha in 6 18.3- ∗ 30.5-m pens. There were 2.5 times more (P < 0.01)

bill contacts/min observed on untreated plots (26.4 ± 6.0; $\bar{x}$ ± SE) compared to treated plots (10.4 ± 3.8) during a 7-day test with captive geese. Mean numbers of geese per observation were also greater (P = 0.02) on untreated plots (2.6 ± 0.4) compared to treated plots (1.4 ± 0.4). Residue analyses indicated AQ declined from 2.02 kg/ha at application to 0.22 kg/ha after 1 week. Individually caged cowbirds were presented untreated millet or millet treated with FC at 0.1, 0.5 and 1.0% (g/g) levels in 1- and 2-choice tests for 3--4 days. Flight Control™ was repellent to cowbirds at all levels in both 1- and 2-choice tests. In the 2-choice test, birds in the 1.0% treatment level lost body mass (P = 0.04), whereas birds at the other levels did not. Each group of treated birds in the 1-choice test lost mass ($P \leq 0.01$), whereas the control group did not. Birds in the 0.5 and 1.0% groups ate minimal amounts; 3 of 12 birds died. We conclude that FC was an effective foraging repellent for Canada geese in a 7-day pen experiment and for brown-headed cowbirds as a seed repellent in aviary experiments. Flight Control™ shows promise as an avian feeding repellent. Further lab and field studies are needed to refine minimum repellent levels and to enhance retention of AQ on treated vegetation.

26. Gabrey, S. W., and R. A. Dolbeer. 1996. Rainfall effects on bird-aircraft collisions at two United States airports. Wildlife Society Bulletin 24:272-275. ***Abstract:*** We examined the influence of rainfall on bird-aircraft collisions at 2 major United States airports. Presence of standing water from rainfall did not increase the probability of bird-aircraft collisions at John F. Kennedy International airport during April-October, 1986-1990. However, at O'Hare International Airport there was evidence that standing water increased collision rates. During April-October 1992-1994, collision rates were higher 1 day after ≥2.54 cm rain than at other times. Although this analysis showed no clear-cut influence of rainfall on bird-aircraft collisions, airport operations personnel, as precautionary measures, should continue efforts to remove standing water and deter bird use of puddles. Detailed long-term data on daily bird-aircraft collisions, rainfall, and bird use of standing water are needed from other airports so that a more comprehensive and generalized analysis of collisions in relation to rainfall can be made.

27. Woronecki, P. P., R. A. Dolbeer, T. W. Seamans, and W. R. Lance. 1992. Alpha-chloralose efficacy in capturing nuisance waterfowl and pigeons and current status of FDA registration. Proceedings of the Vertebrate Pest Conference 15:72-78. ***Abstract:*** During 1990 and 1991 we conducted safety, efficacy and clinical trials required to register alpha-chloralose (A-C) for capturing nuisance waterfowl and pigeons with the U.S. Food and Drug Administration (FDA). We determined the Most Effective Dose (MED) to be 30 and 60 mg of A-C/kg of body weight for capturing waterfowl and pigeons, respectively. We conducted 11 field trials in 4 states, capturing 587 waterfowl and 1,370 pigeons with 8% mortality for ducks, 0% for geese, and 6% for pigeons. We submitted a New Animal Drug Application to FDA in October 1991 and received registration in 1992 for use of A-C by Wildlife Services biologists.

DEER

28. Belant, J. L., T. W. Seamans, and C. P. Dwyer. 1996. Evaluation of propane exploders as white-tailed deer deterrents. Crop Protection 15:575-578. ***Abstract:*** In response to increased white-tailed deer (*Odocoileus virginianus*) depredation of agricultural crops and encroachment on airports, we evaluated the effectiveness of systematic and motion-activated propane exploders as deer frightening devices. We conducted 3 experiments in a 2200-ha fenced facility in northern Ohio with high (91/km^2) deer densities during 1994-1995. Systematic exploders were calibrated to detonate once at 8- to 10-minute intervals whereas motion-activated exploders detonated 8 times/deer intrusion. Systematic propane exploders were generally ineffective, deterring deer from corn for $\leq$2 days only, whereas motion-activated exploders repelled deer for 0-6 weeks. Repellency of motion-activated exploders varied seasonally, possibly in response to variations in deer density, availability of alternate food, or reproductive and social behavior. We recommend motion-activated exploders over systematic exploders as deer frightening devices for crop damage mitigation and on airports; however, systematic exploders may have utility for short-term (a few days) use.

29. Belant, J. L., T. W. Seamans, and C. P. Dwyer. 1998. Cattle guards reduce deer crossings through fence openings. International Journal of Pest Management 44:247-249. ***Abstract:***. In response to increased white-tailed deer (*Odocoileus virginianus*) encroachment on airports, we evaluated the effectiveness of cattle guards as deer exclusion devices. We conducted 3 experiments in a 2,200 ha fenced facility in northern Ohio with high (91/km^2) deer densities during 1994-1995. During each experiment, we monitored deer crossings at 2-3 cattle guards (4.6 [L]x3[W]x0.5 or 1.0[D] m) constructed at fence openings for 2 weeks pre- and post-installation. For each experiment, the mean daily number of deer crossings after installation of cattle guards was reduced ($P < 0.01$) by $\geq$88% compared to respective crossing rates during pretreatment. Reductions in deer crossings using cattle guards with 0.5 or 1.0 m deep excavations were similar (95-96% vs. 98%) overall. Cattle guards at permanent openings used for vehicular traffic appear a viable technique to exclude deer from fenced airports and other facilities where deer exclusion is desired.

30. Belant, J. L., T. W. Seamans, and L. A. Tyson. 1997. Evaluation of three electronic frightening devices as white-tailed deer deterrents. Proceedings of the Vertebrate Pest Conference 18:107-110. ***Abstract***: We evaluated the effectiveness of the motion-activated Usonic Sentry (with and without strobe), motion-activated Yard Gard, and Electronic Guard for deterring white-tailed deer (*Odocoileus virginianus*) from preferred feeding areas during February-April 1996. We conducted 2 4-week experiments, monitoring deer use (number of intrusions and corn consumption) at 8 feeding stations in a 2,200-ha fenced facility in northern Ohio with high deer densities ($\geq$38/km^2). During these experiments, we positioned 1 of the devices at each of 4 sites. The mean ($\pm$ SE, n = 4) daily number of deer intrusions at feeding stations during treatment (96.5 $\pm$ 12.6-169.0 $\pm$ 22.0) was similar ($P \geq 0.13$) to or greater ($P \leq 0.04$) than

the mean daily number of deer intrusions during pre- or posttreatment (109.8 ± 15.6-148.8 ± 21.4). Corn consumption declined ($P < 0.05$) only at stations with Usonic Sentrys without strobes for 1 week. We conclude that the electronic frightening devices tested were generally ineffective in deterring white-tailed deer from preferred feeding areas.

31. Belant, J. L., T. W. Seamans, and L. A. Tyson. 1997. Predator urines do not deter white-tailed deer from feeding areas or trails. Proceedings of the Vertebrate Pest Conference 18:359-362. ***Abstract:*** We assessed whether bobcat (*Lynx rufus*) or coyote (*Canis latrans*) urine could reduce white-tailed deer (*Odocoileus virginianus*) use of established feeding areas or trails. A 4-week experiment evaluating deer use of 8 feeding stations, 4 each with coyote or bobcat urine was conducted at a 2,200-ha fenced facility in northern Ohio with high deer densities (38/km^2). At this same facility, we also monitored deer use of 4 trails where coyote urine was applied. For both experiments, urine was placed in holders positioned at ground level within 2 m of the area being protected . The number of deer entering feeding stations after 2 weeks exposure to predator urines was 15-24% less ($P \leq 0.05$) than the number of deer entering feeding stations during pretreatment. Deer use of trails did not decrease in response to presence of coyote urine. We conclude that predator urines used as a chemical barrier were of limited effectiveness in deterring high concentrations of white-tailed deer from areas with established sources of food and ineffective in deterring deer from trails.

32. Belant, J. L., L. A. Tyson, T. W. Seamans, and S. K. Ickes. 1997. Mylar flags do not deter white-tailed deer from feeding areas. Journal Wildlife Research 2:210-212. ***Abstract:*** We evaluated the effectiveness of mylar flags for deterring white-tailed deer (*Odocoileus virginianus*) from feeding areas during December 1996. We conducted a 3-week experiment, monitoring deer use (number of intrusions and corn consumption) at 10 feeding stations in a 2,200-ha fenced facility in northern Ohio with high deer densities (>21/km^2). We positioned 2 mylar flags (15 cm x 1 m) attached to lathe at each of 5 sites; remaining sites received lathe only (untreated). Mylar flags did not reduce ($P \geq 0.43$) the number of deer intrusions into feeding stations or the amount of corn consumed relative to feeding stations without mylar flags. We conclude that mylar flags are ineffective for deterring white-tailed deer from feeding areas during winter.

APPENDIX L

A WETLAND BANKING MITIGATION STRATEGY FOR FAA

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A WETLAND BANKING MITIGATION STRATEGY FOR FAA

JULY 1996

Ed Melisky, Office of Airport, Community and Environmental Needs Division (APP-600), Ann Hooker, Office of Environment and Energy (AEE-300), and Jerry Schwartz, Office of Communications, Navigation, and Surveillance Systems (AND-420).

Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC 20591 (202-267-5869).

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PREFACE.

This document describes the concept of wetland mitigation banking and how the FAA and airport sponsors can use this newly accepted mitigation strategy to more efficiently meet Section 404 permit requirements and environmental responsibilities. Wetland mitigation banking, although not a new ecological idea, is rapidly gaining support from all levels of government and private developers because it offers a proven, cost-effective way to compensate successfully for unavoidable wetland impacts. An example of this recent acceptance is the November 28, 1995, joint issuance of wetland banking guidance by five federal agencies that once held widely divergent views on wetland banking.

This document does not provide instructions on implementing a wetland banking strategy, since each FAA service has specific operating procedures to accomplish its respective mission. Instead, this document provides information and "ground rules" that each service should follow as it "custom designs" wetland banking instructions that meet the service's particular needs.

This document does not discuss building a wetland bank, but, instead, emphasizes and provides information on purchasing credits from an agency or person or "banker" operating such a facility. Operating a wetland bank requires extensive knowledge of complex wetland management techniques and specially trained personnel. Since the primary mission of the FAA and airport sponsors is aviation, the purchase of credits from a wetland banker frees the FAA and airport sponsors to concentrate on the complex business of managing aviation, not the complex business of managing wetlands. Anyone wishing to build a wetland bank should contact environmental specialists in the Office of Airports (202-267-5869) or the regional Army Corps of Engineers (COE) office for information.

I. WHAT IS WETLAND MITIGATION BANKING?

Wetland mitigation banking provides a way to mitigate unavoidable wetland impacts before those impacts occur. Purchasing credits from a bank does not give the purchaser title to wetlands tracts that comprise a bank. Rather, the purchase is simply a payment to the wetland banker for wetland mitigation services that the bank provides.

To establish a wetland bank, the banker owning and/or managing the bank can restore, enhance, or create wetlands within a watershed or region. Implementing one of these measures or a combination of them is necessary to replace the wetland functions lost due to constructing a project within a wetland. In rare instances, preserving existing, high quality wetlands is an acceptable banking plan, but this is rarely the case because it does not truly meet the President's "no net loss" policy for wetlands. Once a bank is established and the COE has approved the bank's use, the banker is allowed to sell

credits from the bank to 404 permittees (see section **II**). The sale of credits from a bank signifies that the bank is capable of:

- replacing wetland functions in a watershed where unavoidable development of a wetland occurs; or

- providing wetland functions that are necessary to achieve a designated wetland management plan in the affected watershed.

II. WHY WOULD THE FAA OR AIRPORT SPONSOR WANT TO USE WETLAND MITIGATION BANKING?

Section 404 of the Clean Water Act requires any one seeking authority to dredge and/or fill a wetland (404 permittee) to obtain a Section 404 permit before conducting those activities. One of the steps in the 404 permit application process requires the permit applicant to show that the proposed action includes ways to minimize unavoidable wetland impacts. This is where wetland banking plays a role.

If the COE issues a 404 permit authorizing dredge and/or fill activities in a wetland, that permit will probably contain requirements compelling the permittee to implement a plan to reduce the project's unavoidable wetland impacts. Because wetlands are ecologically complex and dynamic, the development of a wetland mitigation plan capable of replicating or replacing lost functions is often the most difficult and time consuming step of the 404 permit process. For most aviation-related projects built in wetlands, the FAA program office or the airport sponsor, as the permittee, is responsible for complying with permit required mitigation measures. Wetland banking will help FAA program offices and airport sponsors to satisfy 404 permit conditions in a cost-effective and efficient manner.

Wetland banking will enable the FAA to achieve the President’s regulatory streamlining efforts and to achieve the Administration's long-term goal of increasing the quality of the Nation's wetlands. In addition, wetland mitigation banking has the following potential benefits:

- Banking can increase the quality of the Nation's wetlands.

- Banking is part of DOT's strategy to take a pro-active approach in addressing environmental issues and improving its working relationships with federal, state, local, and private agencies responsible for protecting wetlands.

- Banking provides FAA program offices and airport sponsors with a strategy for satisfying resource agency demands and mitigating wildlife and wetland impacts, while reducing wildlife and bird hazards to aviation.

- Because banking enhances the probability that FAA or an airport sponsor will obtain Section 404 permits in a more timely manner, the FAA or airport sponsor would be better able to meet tight construction deadlines more often and to complete essential projects more quickly.

- The purchase of credits from a wetland bank absolves the FAA or a project sponsor of the responsibility for undertaking, monitoring, and maintaining a complex, often difficult, wetland mitigation plan. As a result, the FAA and the airport sponsor can focus primarily on aviation needs, not on managing a wetland.

- Since the price of credits from a particular bank are known, banking can greatly enhance the ability of FAA program offices or airport sponsors to estimate the financial costs of mitigating unavoidable project-related wetland impacts.

III. IS WETLAND MITIGATION BANKING NEW TO THE FAA?

Yes, but it isn't new to land developers, who have used wetland banks for the past 10 to 15 years. What is new is the acceptance of wetland banking by state governments and federal agencies. These parties now realize that wetland banking offers far greater ecological benefits than many of the on-site strategies commonly used today to mitigate wetland impacts. Examples of this new way of thinking are:

- The development of regulations and guidelines governing wetland banking by the federal government and the states of California, Florida, Maryland, Minnesota, and Oregon.

- The commitment of The Urban Land Institute, an organization of federal and state agencies, private land developers, and environmental groups, to provide administrative support, expertise, and a forum that allows interested parties to discuss openly and constructively their respective wetland mitigation banking concerns and problems.

- The Administration's commitment to wetland banking by convening a federal inter-agency task force that developed mutually acceptable banking guidelines.

- The Federal Highway Administration's (FHWA) program to encourage the use of wetland banks for roadway projects and its issuance of banking guidelines.

- FHWA's financial participation in the establishment of wetland mitigation banks for highway projects throughout the USA.

- The purchase of thousands of wetland acres in Florida by aviation departments to mitigate project-related wetland impacts.

- The State of Florida's acceptance of the Walker Ranch Bank to show that a privately financed bank can be used to mitigate successfully unavoidable impacts to thousands of acres of Florida wetlands.

IV. BANKING SOUNDS LIKE A GOOD IDEA.

In response to the President's support for wetland banking, the COE, the National Resources Conservation Service (formerly the Soil Conservation Service), EPA, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service have embraced wetland banking and have issued final guidelines (*Federal Register*, Vol. 60, No. 228, November 28, 1995). California, Florida, Minnesota, and other states have recognized the value of banking and actively promote it.

To protect wetlands, Executive Order 11990 and various regulations require 404 permit applicants to ensure that federal agencies complete the sequencing procedure (item **VII).** This safeguard should suffice to ensure that the selected wetland site is truly the only practicable alternative that would meet a proposed project's specifications, purpose, and need. In addition, the inter-agency wetland mitigation banking guidelines require the COE and other federal resource agencies to oversee the permit process to ensure that sequencing occurs and to ensure that the banks successfully mitigate wetland impacts.

V. ARE FAA PROGRAMS OR AIRPORT SPONSORS REQUIRED TO USE WETLAND MITIGATION BANKING FOR ALL ACTIONS AFFECTING WETLANDS?

No. Banking is strictly a voluntary way to satisfy wetland mitigation requirements. The FAA and airport sponsors may continue to engage in more traditional wetland mitigation approaches. Different mitigation strategies may be pursued for different programs or projects. Appropriate wetland banks may not always be available. In summary, each FAA program office or airport sponsor has the option of using or not using wetland banking for each project under its purview.

If the 404 permit applicant chooses to use wetland mitigation banking, he/she may consider two options:

- Under option one, the 404 permit applicant may propose to build a wetland bank within the same watershed as the proposed project and use credits from that bank to mitigate unavoidable wetland impacts resulting from proposed and future actions. The COE must approve the use of the banked credits as mitigation for wetland functions or values lost due to each particular project. In this situation, the permittee is responsible for wetland success.

Note: *FAA offices and airport sponsors are less likely to choose option one. The complex, dynamic nature of wetlands requires specialists in wetland management.*

The FAA and sponsors normally don't possess this expertise, so wetland banking option Two (below) would be the more likely choice.

- Under option two, the 404 permit applicant can agree to purchase a specific number of credits from a bank owned by another party, provided the bank is in the same watershed as the proposed project and the permitting agency approves such a measure. Here, the banker is responsible for wetland success.

Here are two examples of the available wetland mitigation options:

An airport development project:

An airport sponsor proposing a new runway knows that constructing this facility would require filling 50 acres of wetland and that a taxiway proposed for construction 2 years later would require the filling of 10 additional wetland acres. To mitigate these impacts, the sponsor can select one of the following options and present it to the COE for approval:

- mitigate wetland impacts by traditional replacement methods that are consistent with FAA safety concerns (i.e., new wetlands should not be established in areas where they could create hazards to aviation);

- establish a 60-acre bank offsite before beginning construction of either project; or

- buy 60 credits from an acceptable, offsite wetland bank that is owned by a wetland banker who meets the criteria in item **VIII**.

NOTE: *1:1 impact:compensation ratios in the above examples are sometimes, but not always, acceptable.*

Siting a FAA facility:

The division office planning to site a radar at a preferred location knows that construction specifications would require the filling of 2.2 acres of wetlands for foundations to support the radar's superstructure and pilings to support a 0.5-mile long access road. To mitigate these impacts, the program manager could select one of the options discussed above to offset the 2.2-acre loss.

VI. WHO IS RESPONSIBLE FOR MAINTAINING A WETLAND MITIGATION BANK?

When a 404 permittee such as an FAA program office or airport sponsor purchases credits from a bank meeting the criteria in section **VIII.**, the banker operating that bank is solely responsible for maintaining the bank, ensuring that it is fully-functional and

that it meets its intended purposes. Those purposes are clearly stated in a Memorandum of Understanding between the banker and the COE. If the COE authorizes the 404 permittee to use a designated bank, the purchase of credits from that bank fulfills the permittee's wetland mitigation obligations. The permittee has no further wetland mitigation responsibilities.

VII. WHAT IS SEQUENCING?

Sequencing is a federally-required, analytical procedure that all 404 permit applicants must complete as part of the 404 permit application process. This process follows a similar process required by the regulations implementing the National Environmental Policy Act (see Council on Environmental Quality regulations at 40 CFR section 1502.2(f)). Before using banking or any other measure to mitigate wetland impacts, the 404 permit applicant **must** complete the sequencing procedures described below.

1. Evaluate practicable alternatives. When proposing an action that would affect wetlands, section 2 of Executive Order 11990 and paragraph 5 of DOT's wetland order (5660.1A) require the appropriate FAA program office to demonstrate that there are no practicable alternatives that avoid the wetland. For DOT purposes, a practicable alternative is an alternative that is feasible when safety, transportation objectives, design, engineering, environment, and economics are considered. If a practicable alternative exists, the Executive Order and the DOT order require the FAA decision maker to select it. DOT's wetland order states that additional project expenses to mitigate wetland impacts or to implement an alternative do not make the mitigation or alternative impractical, since such expenses are normally considered necessary to meet national wetland policy objectives.

2. Minimize unavoidable adverse impacts. The aviation safety or aeronautical design requirements of many facilities often do not allow the responsible FAA program office or airport sponsor to build a needed facility outside a wetland. For example, to meet location and distance specifications necessary for some radars to perform their aeronautical function properly, the radars must be built at specific locations, some of which may be in wetlands. When no practicable alternative outside a wetland exists because of radars' performance requirements, the responsible FAA program office must demonstrate that the radars have been designed to minimize wetland impacts to the greatest extent practicable. An example of a design consideration that would minimize unavoidable wetland impacts is to place radar supports on pilings, instead of excavating and filling the wetland to accommodate a foundation for the supports.

3. Compensate wetland impacts that occur. After modifying the design to minimize wetland impacts, the FAA program office or airport sponsor must then compensate for any remaining adverse wetland impacts that occur due to constructing, operating, and/or maintaining the proposed facility. At this point, wetland banking is a mitigation option.

VIII. IF AN FAA SERVICE OR AIRPORT SPONSOR CHOOSES TO USE A WETLAND MITIGATION BANK, HOW DOES IT DECIDE IF A PARTICULAR BANK IS ACCEPTABLE FOR FAA PURPOSES?

To meet the provisions of this strategy, the FAA program office or airport sponsor must complete the following steps before purchasing credits from a bank.

1. Ensure that the bank does not pose a threat to aviation. Wetlands and wetland banks provide excellent habitats for birds and wildlife hazardous to aviation. Although it is ecologically desirable to restore or enhance affected wildlife habitat at or near the project site to maintain ecological functions in a watershed, aircraft accident investigations have shown that hazardous wildlife attracted to wetland habitats near airports sometimes collide with aircraft causing costly damage to aircraft or injury or death to aircraft occupants. Therefore, to minimize wetland-related risks to aviation safety, FAA program offices and airport sponsors are strongly encouraged not to establish a bank or purchase credits from banks that are located within:

- 5,000 feet of a runway that serves piston-powered aircraft; or
- 10,000 feet of a runway that serves turbine-powered aircraft.

NOTE: *These distances are based on a study completed by the Office of Airports' Airport Safety and Operations Division (AAS-300) that assessed aircraft approach and takeoff profiles and bird flight behavior .*

FAA program offices and airport sponsors may consider using a wetland bank not meeting these distance criteria only when the bank provides special ecological functions such as:

- maintaining habitat essential to federally-listed endangered or threatened species; or
- maintaining unique wetland functions (e.g., aquifer recharge, flood control, filtration).

When these special ecological functions exist, the FAA program office or airport sponsor should consult AAS-300 at (202) 267-3389. AAS can provide recommendations for a wildlife hazard management plan to protect aviation safety.

2. Consult the appropriate wetland resource agencies. A 404 permit applicant must consult with the COE, the U.S. Fish and Wildlife Service, (the National Marine Fisheries Service when marine mammals or anadromous fish species are involved), the EPA, and the state agency having jurisdiction over the affected wetland. Consultation should focus on the agencies' respective concerns for wetland values and functions that the proposed project would affect and any applicable watershed or ecosystem

conservation plans. Agencies should state if they will accept wetland banking as appropriate mitigation; however, as the ultimate 404 authority, the COE is responsible for authorizing the use of a particular bank and determining the number of credits required.

3. Select only COE-approved wetland banks. For permitting purposes, the COE will not allow a permittee to use a wetland bank that does not meet the success criteria stated in the Memorandum of Understanding (MOU) between the COE and the banker that establishes the wetland bank. If the 404 permittee chooses to buy credits available from a bank owned by another agency or a private entity, the responsible FAA program office must have written proof that the COE has approved the bank. This provision ensures that permittees will be dealing with a reputable wetland banker who has met federal wetland mitigation guidelines.

In most cases, the COE will base success on a wetland bank's ability to provide those wetland functions that resource agencies have determined are necessary to protect a particular ecological system or watershed. Examples of such functions are floodwater retention, sediment control, providing fishery or wildlife nursery areas, removing toxic substances, or aquifer recharge. If the permittee will purchase credits from a banker, the banker should provide written assurances that the wetland mitigation bank will be self-sustaining within 3 to 5 years, the period during which most wetlands become self-sustaining.

NOTE: *For projects in Michigan and New Jersey, consult with the state wetland permitting agency. The COE and EPA have authorized these states to administer the Section 404 permitting process for wetland actions within respective state boundaries.*

4. Ensure that the wetland banker has posted an appropriate environmental performance bond. When purchasing credits from a bank meeting the criteria discussed in the above items, the FAA program office or airport sponsor must also ensure that the banker has posted an environmental performance bond equal to 100% of the cost needed to build or establish a bank that meets the objectives stated in the MOU. This bond ensures that sufficient money is available for the wetland bank to meet the success criteria in item **3.**, if the banker goes out of business or declares bankruptcy. The banker should provide written proof of bonding to the FAA or airport sponsor.

5. Exercise fiduciary responsibilities. As a federal agency entrusted with allocating or using federal funds, the FAA program office must be financially responsible when mitigating wetland impacts or providing money to do so. Although wetland impacts must be properly mitigated, the program office must ensure that it does not overpay for credits purchased from a bank. FAA project offices or airport sponsors should negotiate with the permitting and resource agencies to ensure that the number of credits purchased fairly reflects unavoidable project-related wetland impacts. They should also negotiate to secure a fair price for those credits.

IX. HOW TO DETERMINE THE NUMBER OF CREDITS THAT MUST BE PURCHASED.

Determining the number of credits that must be purchased is done on a case-by-case basis. This should be a point of negotiation among the 404 permitting agency, other resource agencies, and the 404 permittee. Experience shows that the number of credits purchased should be based on the functions lost or diminished due to project construction, the functions that the bank provides, and/or the role that surrounding upland areas play in increasing the bank's overall ecological functions. Examples of compensation : impact ratios (usually expressed in acres) are:

4:1 when credits are sold to create a buffer between a wetland and other uses;
3:1 when credits are sold to protect uplands essential to wetland survival;
2:1 when credits are sold in a bank being established; or
1:1 when credits are sold in a functioning bank;

NOTE: *Actual negotiations may result in different ratios!! The above ratios are based on information from workshops and discussions with wetland bankers and wetland bank customers. They are presented only as generic guidelines.*

X. HOW WILL THE FAA OR AN AIRPORT SPONSOR PURCHASE CREDITS FROM A WETLAND MITIGATION BANK?

When the FAA program office or airport sponsor purchases credits from a bank, it will do so via a legally binding purchasing contract. Contract signatories should include the 404 permitting agency (usually the COE), the appropriate resource agencies, the wetland banker, the responsible FAA program office and, when appropriate, the airport sponsor. The contract should contain the following contingencies to protect FAA funding and aviation safety.

1. Protection against wetland bank failure. This contingency is necessary to protect the FAA from spending additional funds on wetland mitigation after it has provided funds to purchase the permit-required number of bank credits. This contingency verifies that if a bank failure occurs, the FAA program office or the airport sponsor is not accountable for any future wetland mitigation requirements that are needed to satisfy the applicable permit. The purchasing instrument should contain the following statements:

- the purchase of a specified number of credits from the named bank completely satisfies the permittee's wetland mitigation responsibilities; and

- in the event of a bank failure or bankruptcy, the permittee is not responsible for any future financial responsibilities or other liabilities needed to mitigate wetland impacts that result from a 404 permit-authorized action.

2. Protection from wildlife hazards. Written verification that the bank is not within the 5,000 or 10,000-foot criteria discussed earlier (see section **VIII**) shows that the bank providing the credits should not pose hazardous conditions to aviation.

NOTE: *In situations where a wetland fulfills unique functions, such as serving as recharge areas for water supply aquifers or as habitat for federally-listed endangered or threatened species, the above distance criteria may not be applicable. In such cases, contact AAS-300 for assistance.*

XI. WHAT HAPPENS TO THE BANK WHEN ALL OF THE BANK'S CREDITS ARE SOLD?

Once the COE determines that a bank is self-sustaining, and the banker has sold all of its available credits, the banker has at least three options to ensure the wetland exists in perpetuity:

- retain ownership of the wetland bank and continue to manage it;

- transfer ownership of the wetland bank to a state or a Native American tribe, if either party desires to take possession of the bank to enhance its wetland sources; or

- transfer the wetland bank to an environmental group whose primary mission is to protect wetlands and/or wildlife habitat.

Organizations having expertise in wetland management, such as state wetland or wildlife agencies or The Nature Conservancy, often seek title to banks, since their primary missions are to protect valuable wetland functions and habitats.

A NOTE REGARDING AIP-FUNDED CREDIT PURCHASES. *When the FAA approves an airport development project that causes wetland impacts and requires the sponsor to mitigate those impacts, the airport sponsor may recover the costs of establishing a wetland bank or purchasing credits from a wetland bank. AIP funds can be used to reimburse the sponsor for the cost of building only that portion of its wetland bank that is used to mitigate impacts resulting from a specific, FAA-approved action. The cost of building the entire wetland bank is not AIP reimbursable, unless other FAA-approved airport developments use the remainder of the bank to mitigate wetland impacts. AIP funds may also be used to reimburse the sponsor for purchasing a specified number of credits from a bank owned by another party to mitigate project-specific wetland impacts resulting from FAA-approved airport actions.*

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